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SPECIAL ISSUE: PARTS AND WHOLES

Edited by Wolfgang Mann and Achille C. Varzi

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THE JOURNAL OF PHILOSOPHY
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FOREWORD

Part-whole theories, or mereologies (from the Greek word *μέρος*, meaning "share," "portion," or "part"), form a central chapter of metaphysics throughout its history. Their roots can be traced back to the earliest days of philosophy, beginning with the Pre-Socratics. It is plausible to hold that Parmenides argues that there can be no parts, thus everything there is is one whole, and Zeno argues for his striking paradoxes on the assumption that there are parts (whether spatial or temporal ones). Democritus introduces the idea that everything consists of *atoms* (literally "indivisibles") which are themselves simple, that is, partless, Anaxagoras, on the other hand, maintains that everything consists of basic *stuffs* which are infinitely and homogeneously divisible: any portion of such a stuff is the same sort of stuff, and any portion, no matter how small, can be divided into further such portions. Sophisticated analyses in terms of parts and wholes figure prominently in the writings of Plato (especially in the *Phaedo, Republic, Theaetetus, Parmenides, Timaeus,* and *Philebus*) and Aristotle (most notably in the *Metaphysics,* but also throughout his logical, natural philosophical, and even his ethical treatises). And in Hellenistic times, both the Epicureans and the Stoics rely on mereologies—and claims about the kinds of parts and wholes that exist—in order to frame certain of their central theses. The interest in mereologies continues throughout the philosophy of antiquity, as evidenced, for example, by Neoplatonist thinkers like Plotinus and Proclus.

Boethius played a crucial role in transmitting ancient thought to the Middle Ages, and in works such as *De Divisione* and *In Ciceronis Topica* (and in his translations of Aristotle's *Categories* and *Topics*) he made mereological claims and questions available to early medieval philosophy. These were taken up by, for example, Peter Abelard (and his immediate predecessors and contemporaries). The introduction of the bulk of Aristotle's writings to the Latin West provided a major

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impetus to Scholasticism in all areas of philosophy. Thus familiar figures like Thomas Aquinas, John Duns Scotus, William of Ockham, and Jean Buridan—as well as many far less well-known thinkers, whose works are only now beginning to be explored—offer ingenious treatments of subtle ontological questions by drawing on, for example, Aristotle's *Metaphysics*, and using the lessons they learned there for their own ends. Here, too, mereological considerations often play a leading part.

Mereologies occupy a prominent place also in early modern philosophy. Some examples, taken almost at random: Jungius's *Logica Hamburgensis* (1638), Leibniz's *Dissertatio de arte combinatoria* (1666) and *Monadology* (1714), and Kant's early writings (especially the *Monadologia physica* of 1756). (Such a list could obviously be substantially lengthened.)

But as fully rigorous theories of part-whole relations, that is, of the relations of part to whole and the relations of part to part within a whole, mereologies made their way into our times mainly through the work of Franz Brentano and that of his pupils, especially Edmund Husserl. The third of Husserl's *Logical Investigations* (1901) may rightly be considered the first attempt at a thorough formulation of a full-fledged theory, though in a format that makes it difficult to disentangle the analysis of mereological concepts from that of other notions (such as the relation of ontological dependence). It is not until Stanisław Leśniewski's *Podstawy ogólnej teoryi mnogości* ["Foundations of a General Theory of Sets"] (1916) that a pure theory of part-whole relations was given an exact formulation. Yet because Leśniewski's work was largely inaccessible to the wider philosophical community, it is only with the publication of Henry Leonard and Nelson Goodman's "The Calculus of Individuals" (1940) that mereology has become a chapter of central interest for modern philosophers. Indeed, although Leśniewski's and Leonard and Goodman's theories come in different logical guises, they are sufficiently similar to be recognized as a common basis for most subsequent developments, a single theory often referred to as "classical mereology."

As it turns out, however, just how *classical* classical mereology is, and how plausible it is *vis-à-vis* the broad spectrum of metaphysical questions that involve part-whole theorizing, is today subject to much controversy. Always in the background of the debate—and sometimes very much in the foreground—are questions such as the following:

(1) Both Leśniewski's and Leonard and Goodman's original theories betray a nominalistic outlook, resulting in a conception of mereology as an ontologically parsimonious alternative to set theory. Today it is generally agreed that there is no essential link between

mereology and nominalism True, mereology—unlike set theory—is not committed to the existence of *abstracta* the whole can be as concrete as the parts But this does not mean that mereology carries any nominalistic commitments for the parts can be as abstract as the whole (one may even consider applications of mereology to the set-theoretic universe) Still, to what extent does the formulation of classical mereology reflect, or suffer from, its original nominalistic biases? How much of it depends on the thought that we live in the austerity of a nominalistic universe?

(2) Is classical mereology a *formal* theory—that is, a theory of certain formal structures that are realized or exemplified across a wide range of domains, whatever the nature of the entities included therein—or is it a *substantive* piece of metaphysics? For instance, classical mereology involves decomposition principles to the effect that whenever something has a proper part, it has more than one—that is, that there is always some *mereological difference* (a remainder) between a whole and its proper parts Are such principles generally acceptable, or does their validity depend on the (sorts of) entities one considers? Conversely, classical mereology involves composition principles to the effect that whenever there are some things, there exists a whole that consists exactly of those things—that is, that there is always a *mereological sum* (or fusion) of any number of parts (of whatever sort) Are these principles generally acceptable? If not, is there any systematic and illuminating way of determining which sums exist, and which do not?

(3) Classical mereology is *extensional* it says that sameness of proper parts is necessary and sufficient for sameness *tout court* How do our views concerning identity and persistence bear on this principle? The *sufficiency* claim is often challenged on the grounds that some entities appear to differ exclusively with respect to the arrangement of their parts (two sentences made up of the same words), or by virtue of having different properties that do not manifest themselves in any mereological difference (the properties of a completed jigsaw puzzle versus those of the "mere sum" of all its pieces) Conversely, it is often argued that the possibility of mereological change implies that sameness of parts is not *necessary* for identity if Tibbles the cat survives the loss of his tail, then Tibbles *cum* tail (before the accident) and Tibbles *sine* tail (after the accident) are numerically the same in spite of their having different proper parts Are such objections detrimental to classical mereology? Are they tenable at all?

(4) Mathematically, classical mereology is isomorphic to a complete Boolean algebra with the zero element removed there is no "null entity" which is part of everything (though there is a "universal

entity" of which everything is part) Nominalistically this is perfectly reasonable Where and when would the "null entity" enjoy its existence? On the other hand, what reasons are there to retain this embargo in a less austere metaphysical theory? And what reasons are there to accept a universal entity, if its parts belong to different (perhaps, wildly different) ontological categories? Also, classical mereology is compatible with the existence of atoms, or "simples"—entities with no proper parts Are there any such entities? And if there are, are any of them spatially extended? Is everything entirely made up of simples? Does everything comprise at least some simples, or is there room for what is sometimes called "atomless gunk"—"gunk" any portion of which, no matter how small, can be further divided?

(5) Even in relation to the nominalist's favored realm, the realm of spatiotemporal particulars, there is room for fundamental metaphysical disagreement Such entities have *spatial parts,* parts whose spatial location does not coincide with that of the whole Your hands are spatial parts of your body in this sense, and from this window we can only see part of the parade, not all of it Some entities have *temporal parts,* too, or so one may be inclined to say The first inning is a temporal part of the whole baseball game in this sense it occupies a shorter stretch of time, and much more will have to happen before the game—this particular game—is over But do all entities have temporal parts? Do your hands and body extend over time in the same way in which they extend over space? Do *objects* have temporal parts in the same sense in which *events* do? Do *all* spatiotemporal entities consist of spatiotemporal parts?

These are just some examples, but they are indicative of the breadth and depth of the philosophical terrain that lies underneath any serious talk of parts and wholes This issue of *The Journal of Philosophy* contains contributions devoted to an exploration of questions such as these from a variety of perspectives, in an effort to provide material toward an assessment of, and to raise new challenges for, what has become one of the central debates in contemporary metaphysics

WOLFGANG MANN
ACHILLE C VARZI

REAL WHOLES, REAL PARTS
MEREOLOGY WITHOUT ALGEBRA*

> In the case of all things which have several parts and in which the totality is not, as it were, a mere heap, but the whole is something beside the parts, there is a cause, for even in bodies contact is the cause of unity in some cases, and in others viscosity or some other such quality.
>
> —Aristotle, *Metaphysics*, H, 1045a8–10

Mereology is first and foremost a formal *analysis* of the part-whole relation and its cognates. As such it can have little or nothing to say about what parts or wholes there actually are or what is part of what, any more than an analysis of causation could tell us what events there are or what causes what. Standard mereology on the other hand, while it does not tell us unconditionally what wholes and parts there are, does tell us what wholes and parts there are *given* that other wholes and parts exist. For one thing, standard mereology is *extensional*, meaning that no two things have the same parts. Another standard principle of mereology is that of *unrestricted composition* (UC): for any collection of individuals, there is an individual which they compose (with extensionality, a unique individual), called their mereological sum. In particular there is a sum of all individuals, the mereological universe. UC has implications for the question what parts an individual has: for any collection of parts of an individual, there is an individual which is their sum, and it in turn is a part of the whole. Extensionality and UC both go beyond analysis and constitute substantive metaphysical assumptions. I think both are false, but I shall concentrate here on UC. The questions that arise if we reject UC are:

- Under what circumstances do a collection of individuals compose another individual?
- What are the real parts of an individual?

Neither of these questions, I argue, has a formal answer. This is disappointing for those who like their metaphysics to be *a priori*, but it is the only answer acceptable to a mereologist who wishes to remain in accord with the real world.

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*This paper is dedicated to the memory of Chuck Dement.

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I WHY ALGEBRA? A LITTLE HISTORY

Although the concept of a part is one of the oldest and most ubiquitous of formal concepts, formal theories of part and whole, or mereologies, emerged only around 1914–1916, independently, in the works of two philosopher-logicians A N Whitehead and Stanisław Leśniewski Whitehead developed his account of part and whole to serve the abortive fourth volume of *Principia Mathematica* Mereology was the basis of his theory of extensive abstraction, which he employed in "La théorie relationniste de l'espace "[1] Whitehead went on to employ mereology and extensive abstraction to define geometric elements such as points and lines in his *Principles* of 1919 [2] By the lights of later orthodoxy, Whitehead's mereology is distinctly nonstandard He denies the existence of an object[3] having all others as parts, he denies the existence of atoms or partless objects, and he upholds a principle of mereological density, according to which between any two objects *a* and *b* such that *a* is a proper part of *b* there is a third object *c* which is a proper part of *b* and of which *a* is a proper part These principles are at the service of Whitehead's cosmology and by no means metaphysically neutral they go beyond mere analysis of the *part* relation He gives axioms for his mereology in 1919 but his treatment is by *Principia* standards only semi-formal, and he does not focus on establishing such minor formal virtues as independence Algebraic operators such as Boolean sums and products are not stressed, and general complementation is undefinable without a universal object

By contrast, between 1914 and 1916 Leśniewski was obsessing about Russell's Paradox He focused on the idea of a class as the source of the contradiction, and claimed that the problem arose because of an ambiguity in the term 'class' In one sense, the class of all books is nothing but the books I use the word 'collection' for such a plurality of individuals [4] In another sense, the class is an additional individual, what is now standardly known as the mereological sum of all the books It has each of the books as a proper part (assuming there is more than one book) but has no parts which are extraneous to all the books In general, *S* is the sum of the *m*s iff whatever overlaps some *m* overlaps *S* and vice versa A partial mereological sum of some but not necessarily all of the books, such as the sum of all my books, Leśniewski called a set or collection (*mnogość, zbiór*) every part of a partial sum *P* of *m*s overlaps some *m* which is part of *P* The terminology reflected Leśniewski's questionable conviction that his concepts of collection and class were true to the letter and spirit of Georg Cantor, although he was unable to accept the set theory of Ernst Zermelo and later set theorists In 1916 Leśniewski put forward the first axiomatization of this theory of part and sum, under the title "Foundations of the General Theory of Sets," but he later changed the name to "mereology" to avoid confusion with what he called "official" set theory [5] A definitive account of mereology was published in a series of articles from 1927–31 with the title "On the Foundations of Mathematics "

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[1] Whitehead, "La théorie relationniste de l'espace," *Revue de Métaphysique et de Morale*, XXIII (1916) 423–54 This talk was delivered in April 1914 The published version is a translation of the now lost English original

[2] Whitehead, *An Enquiry Concerning the Principles of Natural Knowledge* (New York Cambridge, 1919, 2nd ed , 1925)

[3] The objects of Whitehead's mereology in *Principles* are called "events " I shall ignore this terminology and speak throughout of "objects " What Whitehead himself calls an "object" is not an event but a continuant constituted by a suitable sequence of events By 1929 Whitehead had moved his mereology from events to the regions they occupy See Peter M Simons, "Whitehead und die Mereologie," in Michael Hampe and Helmut Maaßen, eds , *Die Gifford Lectures und ihre Deutung Materialien zu Whiteheads Prozess und Realität, Band 2* (Frankfurt Suhrkamp, 1991), pp 369–88, translation "Whitehead and Mereology," in Guillaume Durand and Michel Weber, eds , *Les principes de la connaissance naturelle d'Alfred North Whitehead Alfred North Whitehead's Principles of Natural Knowledge* (Frankfurt Ontos, 2007), pp 215–33

The titles give the key to Leśniewski's aims in developing mereology He was looking for an antinomy-free foundation for mathematics, and mereology was to do the work that set theory did in other foundational systems To this end it was important that mereology be as strong as possible Leśniewski never doubted that all collections have a unique sum it is one of his original axioms from 1916,[6] and is the mereological counterpart to the axiom of comprehension in naive set theory In the 1920s however, he became so involved with perfecting his logical systems that he did not further develop the original idea of using them as a foundation for mathematics in the style of *Principia*

It was Leśniewski's student Alfred Tarski who first pointed out the similarities between mereology and Boolean algebra extended with infinitary sum and product operators,[7] corresponding to the general mereological sums and mereological product operators[8] Algebraically, extended Boolean algebra differs from mereology principally in lacking a Boolean zero or null element This would be, in Leśniewski's terms, a null object that is a part of every object Quite properly, Leśniewski's intuitions did not allow him to accept such a thing, and he railed against those set theorists who accepted a null set as engaging in specious invention[9] Boolean algebra, even when extended with infinitary operators, is a much weaker theory than standard set theories it has finite models The important difference between mereology and set theory lies not in the algebraically minor issue of whether there is a zero or not, but in the lack of singletons in mereology Leśniewski denied that there is a difference between an object *a* and the singleton of *a*[10] As we know from David Lewis's fusion of mereology with singleton theory to give set-and-class theory (*op cit*), it is in the existence of singletons distinct from their elements that almost all the power and magic of set theory resides In denying this distinction, Leśniewski effectively cut his mereology off from the possibility of providing a foundation for mathematics comparable in expressive and inferential power to set theory Whether that is a good or a bad thing is a moot point Nevertheless, the legacy left to us by Leśniewski[11] is one in which the existence of arbitrary mereological sums is widely regarded as ontologically harmless and methodologically profitable

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[4] It is surprising how many ontologists—unlike Leśniewski—fail to distinguish between a collection of many individuals and the one individual they compose, if they do for example, D L M Baxter, "Many-One Identity," *Philosophical Papers*, xvii (1988) 193–216, David Lewis, *Parts of Classes* (Cambridge Blackwell, 1990), pp 81–87

[5] The term 'mereology' comes from the Greek *meros*, part The regularly formed term 'merology' was already in use for a (now obsolete) part of anatomy concerned with elementary tissues and fluids, this was presumably why Leśniewski coined the irregular term 'mereology', which is now much the more common

[6] Leśniewski, *Collected Works* (Boston Kluwer, 1992), p 135 (Axiom III)

[7] Tarski, "Zur Grundlegung der Boole'schen Algebra I," *Fundamenta Mathematicae* xxiv (1935) 177–98, revised English translation "On the Foundations of Boolean

II FOR AND AGAINST MAXIMALISM A LITTLE ARGUMENT

Leśniewski's intuitions told him that every collection of individuals forms a mereological sum Call this position *mereological maximalism*[12] Other people's intuitions tell them otherwise The theoretical opposite position, *mereological minimalism*,[13] is the view that only simples (atoms) exist[14] Peter van Inwagen comes close to this view he thinks

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Algebra," in his *Logic, Semantics, Metamathematics* (New York Oxford, 1956, 2nd ed , Indianapolis Hackett, 1983), pp 320–41

[8] See Simons, *Parts* (New York Oxford, 1987), p 35

[9] Leśniewski, *Collected Works*, pp 207ff

[10] Leśniewski, *Collected Works*, p 215 "if some object is a singular class, then it is the same object as its single element "

[11] Partly as transmitted through Henry S Leonard and Nelson Goodman, "The Calculus of Individuals and Its Uses," *Journal of Symbolic Logic*, v (1940) 45–55

[12] It is sometimes called *mereological universalism*

[13] Also called *compositional nihilism* and *mereological nihilism*

[14] This position is actually upheld by J Krupp, "Mereological Nihilism Quantum Atomism and the Impossibility of Material Constitution," *Axiomathes* (forthcoming), and considered possible and unrefuted in Gideon Rosen and Cian Dorr, "Composition as Fiction," in Richard Gale, ed , *The Blackwell Guide to Metaphysics* (Malden, MA Blackwell, 2002), pp 151–74 Such negative and sceptical positions have to face the

that the only composite objects are organisms [15] A table, a lake, a leaf, a book are not *bona fide* objects according to van Inwagen, and statements ostensibly about them can and must be paraphrased by statements about their constituent atoms and the way these are arranged and what befalls them Most people's intuitions tell them that minimalism and this near-minimalism are wrong On the other hand when confronted with bald examples of arbitrary mereological sums, such as the sum of a certain blade of grass, a certain water molecule on Mars, and Horatio Nelson's last heartbeat, most people's intuitions tell them there is no such object Clearly, intuitions are not going to decide intersubjectively what is correct If intuitions cannot decide the matter, what of arguments?

I do not intend here to enter into critique of minimalism or van Inwagen's near-minimalism One thing at a time Rather I wish to consider arguments for and against maximalism, and to defend a moderate, nonmaximalist position [16]

The first argument for maximalism is as follows [17] Mereology with unrestricted sums is a consistent theory,[18] so there is no formal contradiction in assuming there is a sum for every collection Mereological maximalism is *harmless* That is not directly an argument *for* maximalism, but it is an argument against some arguments against it More importantly, maximalism allows us to be relaxed about what constitutes a natural whole, or equivalently, about what constitutes a natural as distinct from merely formal part-relation Any condition for natural wholes will have the form

NWS for all x x is a natural whole iff x

where x formulates the condition [19] This schema only has a point if the variable 'x' ranges over a wider domain of quantification than the natural wholes, for otherwise it would be trivial we could have simply 'x exists' or '$x = x$' for the condition Only if some objects are natural wholes and others are not is there a point to giving conditions

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Moorean objection that we seem to know just by looking that some objects are parts of other objects This is not a refutation of course, but it puts the onus of proof on them Krupp has to contend that when I seem to see my finger as part of my hand I am hallucinating (since there are no such objects as my finger or my hand)

[15] Van Inwagen, *Material Beings* (Ithaca Cornell, 1990)

[16] Call any intermediate position *mereological moderatism.*

[17] This is my view in *Parts,* chapter 9

[18] J T J Szrednicki and Z Stachniak, eds , *S Leśniewski's Lecture Notes in Logic* (Boston Kluwer, 1988), pp 109ff , C Lejewski, "Consistency of Leśniewski's Mereology," *Journal of Symbolic Logic,* xxxiv (1969) 321–28

[19] For such attempts, see Simons, *Parts,* pp 330ff

which an object must satisfy to be a natural whole Thus maximalism is methodological *profitable* even within mereology

It may seem unduly inflexible or optimistic to suppose one can define a single overarching concept of natural whole Perhaps there are many different kinds of natural wholes, for example, one for organisms, another for spatiotemporal regions, another for masses of stuff, another for planets, another for galaxies, and so on As long as the variable ranges over the union of all these domains we can define natural wholes of different subtypes by a schema

NW(Z)S for all x x is a natural whole of type Z iff x

and this avoids the problem However against this, if something is a natural whole of *any* of these types then it is a natural whole *tout court*

NW for all x x is a natural whole iff for some Z x is a natural whole of type Z

and we are back where we started since again by hypothesis the left-hand-side predicate is universal if the only objects over which we quantifiy are natural wholes in some sense or other

However, there is no need to express conditions on limited composition in this tendentious way A more flexible approach which accords better with our way of thinking consists in telling us when certain collections of things make up a whole Let us say a collection of objects A *compose* an object w and define this as follows

Df compose (1) A compose w iff every A is part of w and every part of w overlaps some A[20]

Given now any collection of objects A, we may ask whether or not they compose any object When they do we say A *compose*

Df compose (2) A compose iff for some x, A compose x

Although the individual variable x may range only over *bona fide* individuals that are either atomic or composed, the definition is not pointless, because we may *now* ask the question "What does it require for objects A to compose?" and consider schemata for conditions of the form

CompS for all A A compose iff A

Mereological maximalism can now be simply expressed as the following instance of this schema

for all A A compose iff A exist (that is, there is at least one A)

---

[20] Cf Simons, *Parts*, p 327, definition of 'division', and Leśniewski, *Collected Works*, p 135, definition of 'class'

The right-to-left formal implication is simply Leśniewski's axiom for general sums,[21] and the left-to-right formal implication follows from the definitions of 'compose' and simple logic.

Since the question of composition conditions is meaningful for arbitrary collections of individuals A,[22] there is no need to have a broad notion of individual including all sums of all such collections in order meaningfully to raise the question of restricted composition.

A second argument against restricted composition is due to Lewis and Ted Sider.[23] It involves vagueness. Assume that some collections compose and others do not. Whatever conditions are sufficient for composition in a given case, we can imagine a sequence of possible circumstances leading smoothly from noncomposition cases to composition cases. For example, if composition requires some spatial proximity of parts, take a sequence of cases where the prospective summands are too far apart to compose, then imagine a continuous sequence of cases where they are closer together until composition takes place. We are faced with a dilemma. Either the conditions for composition have an exact cut-off, or they do not. If there is an exact cut-off, then this cut-off is arbitrary and metaphysically unmotivated: it could just as easily have been elsewhere. The only natural stopping points in the sequence are the ends: composition always takes place (maximalism) or never does (minimalism). Maximalism is the better of these options. If there is no sharp cut-off, then the individual that is composed in borderline cases neither clearly exists nor clearly does not exist. But an entity which hovers between existence and non-existence is metaphysically repugnant: if any predicate is sharp, it is the existence predicate. Conclusion: maximalism is true.

I agree that the existence predicate is semantically sharp, though it might still be unclear to *us* what things there are. We often also have doubts about when things come into existence or go out of existence, and these could be natural objects like planets and stars, lakes and seas.[24] Can there be vague cases of composition? Lewis and Sider think not Lewis because he presumes that mereological vocabulary is exact—which is begging the question—but Sider, more circumspectly, and profiting from Lewis's mistake, because he thinks we can transform questions about whether composition is vague into questions about whether it is vague how many objects there are Since this can be expressed wholly in logical vocabulary, and logical vocabulary is not vague, it appears that it cannot be vague how many objects there are, as it would have to be if a mereologically moderate position is adopted But where what objects there are depends on whether composition takes place or not, it seems that the concept *object* must itself be vague Simply because this concept is not normally expressed logically as a predicate but is salted away in the specification of a domain of quantification, does not mean it is immune to vagueness [25] Though *composition* may be a vague concept that in itself says nothing directly about what objects there are, since the vagueness may in this case be epistemic

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[21] Leśniewski, *Collected Works*, p. 135 (Axiom III).

[22] The notion of an arbitrary collection of individuals is, by contrast with the notion of an arbitrary sum, unproblematic. Assuming the several individuals exist, nothing more is required for their collection to exist, since they *are* the collection. There may be issues about modes of designating or picking out such arbitrary collections, but that is a matter of expressibility, not existence.

[23] Lewis, *Parts of Classes*; Sider, *Four-Dimensionalism: An Ontology of Persistence and Time* (New York: Oxford, 2001).

[24] The problem of vague objects is a different problem. An object is vague if it is unclear what its parts are—for example, the sun—cf. Simons, "Does the Sun Exist? The Problem of Vague Objects," in Tom Rockmore, ed., *Proceedings of the XX World Congress of Philosophy, Volume II: Metaphysics* (Bowling Green, OH: Philosophy Docu-

III COMPOSITION WITHIN LIMITS

That leaves mereological moderates with the problem of when some objects A compose a whole w and when they do not [26] There is a trivial sufficient condition objects A compose a whole w when they are all the parts of w This is trivial if we allow w as one of the parts It is less trivial but still clearly true if A comprise all of w's proper parts (assuming it is not simple) More interestingly, A need not be all the parts Let A be a collection of proper parts of w which are pairwise disjoint, and such that every part of w overlaps one of A A mereologically *partition* w, and also compose w It is tempting to say that w just is the mereological sum ΣA of the A But this is not true without further ado It is only true if all objects composed of the same parts are identical, not just mereologically equal It is one of clearest formulations of the idea of mereological extensionality Mereological extensionality is not obviously or necessarily true, but for investigating composition it is a side issue A universalist about composition

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mentation Center, 1999), pp 89–97 But the sun clearly exists it is not a borderline case of existence

[25] This in a nutshell is the argument of Kathrin Koslicki, "The Crooked Path from Vagueness to Four-Dimensionalism," *Philosophical Studies*, CXIV (2003) 107–34

[26] Van Inwagen also has this problem He thinks it is a sharp matter of fact whether an organism exists or not That is not obvious There are problems at the ends of life and at the mereological limits of the organism When is something a part and when is it not a part? When does a cluster or colony of organisms form a new individual? I do not think there are sharp boundaries here

will hold that any collection A will compose at least the object ΣA, whether or not it composes another distinct object, and anyone who denies that all collections compose will have to deny that in such cases they compose any sum, let alone anything else

One of the strongest intuitions about mereological composition is that composition cannot take place across categorial divides If a is a concrete individual and b is an abstract entity, there is no sum $a + b$ Likewise if a is an event and b is a substance, or if a is a property trope and b is a state of affairs Composition is always intracategorial Provided we are entitled in some way to consider all objects as belonging to a single universe of discourse, the Universe,[27] then assuming there is more than one category, there are limitations on the universality of composition The principal motivation for this restriction is that otherwise there would be objects which themselves straddle categories, hybrid monsters like a thing which is part substance, part event, part universal, part state of affairs, and so on Against such monsters, the chimeras, gryphons, wyverns, and so on, of myth and heraldry pale into insignificance If there are such monsters, they violate the separateness of categories While they are not as a whole in two or more mutually exclusive categories, they are almost as bad, since they are entities but they do not belong in either At the very least they would require us to set up a ramified system of additional hermaphrodite categories It is far better for classification to simply deny the existence of monsters, and provided it is metaphysically acceptable and semantically congruous to talk in one phrase of things from different categories,[28] this entails denying universal composition [29]

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[27] Cf Simons, "The Universe," *Ratio*, XVI (2003) 236–50

[28] For those who think that it does not make syntactic or semantic sense to conjoin expressions for things of different categories in a single phrase, the question of transcategorial sums cannot properly be formulated

[29] Denying multicategorial composition means denying states of affairs, at least on those conceptions where a state of affairs is literally composed of individuals and a universal This is no burden for those who deny states of affairs Those who have states of affairs in their ontology are unlikely to be held back from accepting them by a *Verbot* on intercategorial composition

If, as I do, one accepts a trope-bundle theory of substance (Simons, "Particulars in Particular Clothing Three Trope Theories of Substance," *Philosophy and Phenomenological Research*, LIV (2004) 553–76) then it would appear that an object composed wholly of things from one category, namely the category TROPE, can be of another category, namely the category SUBSTANCE If that is right, then there is at least one kind of category-crossing composition, and the *Verbot* on category-crossing composition is wrong This is a good argument, but for a different conclusion It is a good reason to deny that there is a categorial distinction between tropes and substances Tropes and substances both belong together in a single category, that of individual THING Without going into details here, there are a number of solid metaphysical advantages to downgrading the substance/trope distinction to an intracategorial one

Under what circumstances do a collection of items from a single category compose a whole of that same category? I think the correct answer has to be variously, but according to a common scheme [30] Consider an equivalence relation *E* which obtains only between objects which are pairwise mereologically disjoint Call such a relation a *disjoint equivalence*[31] If a collection of objects *A* is an equivalence class under *E* we call *A* an *E-family* All cases where objects *A* compose a single whole will be cases where the *A* form an *E*-family for some suitable *E* However, not all equivalence relations are suitable to give rise to composed wholes The equivalence relation $\lambda xy[x$ is one of A and y is one of $A]$ exists for any *A* with mereologically disjoint members, so a principle saying there are wholes for each such relation will entail the existence of arbitrary disjoint sums, and if we drop the requirement of mereological disjointness would entail maximalism Both are too liberal So the question arises as to what additional requirements a disjoint equivalence *E* must satisfy in order to give rise to wholes in addition to equivalence families The embarrassing answer is that I do not know This may stem from mere personal ignorance, or it may be that no general condition can be given, because the ways in which unity arises are too multifarious to permit of enlightening formulation In this we are no further on than Aristotle, who accepted that unity comes about in manifold ways but gave no general recipe [32]

I shall moderate this confession of ignorance with two observations The first is that in genuine cases of unity we usually find it fairly easy to specify the equivalence required, and, second, that in the most prominent cases the equivalence involves causality While the ways in which causality may enter into the composition of wholes themselves probably vary widely, not least because total and partial causality are not symmetric, one feature distinguishing many of the pathological examples of sums which are not natural wholes is that some parts of said putative sums are causally isolated from one another, or are causally connected in a way much weaker than the way in which the parts of a natural whole are linked For example, a church building is a reasonably well delimited whole, as am I The fact that one day I see a church and walk into it and touch parts of it brings the two of us into causal interaction, but not of a sufficiently robust and constitutive kind to weld the church and myself into a single whole

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[30] See Simons, *Parts*, chapter 9

[31] It might be that in some cases the requirement of disjointness is unreasonably strong However, in cases I have considered it appears to be fairly easy to trade in an equivalence relation which is not disjoint for one which is, so it is not clear the restriction makes a material difference

[32] See the motto at the beginning

IV CASE STUDIES OF WELDING

Let us call an equivalence relation which *does* suffice to weld a collection of objects into a single whole a *welding relation*

IV 1 A Helium Nucleus A helium-4 nucleus is a natural whole, one of the simplest kinds in the universe It consists of two protons and two neutrons, held together by the strong nuclear force We thus have a clear candidate for the welding relation, which is λxy[*x* is linked by the strong force to *y*], or λxy[*x* exchanges gluons with *y*] In general, atomic nuclei are welded by this relation or its disjoint ancestral [33]

IV 2 A Pebble A pebble is a natural whole, held together by electromagnetic attraction It is materially distinct from its surroundings, and is rigid, moving as a whole with little distortion when moderate forces act on it The welding relation is probably something like the ancestral of λxy[*x* and y are interacting disjoint material particles closer together than *r*], where *r* is a suitably small radius which we can ask scientists to determine The causal factor enters into this relation via the idea of interaction

IV 3 The Earth The Earth is a natural whole consisting of all those bodies, large and small, which are held together by gravity and remain in close proximity because of this [34] Gravitational attraction is not the welding relation, because the Moon and many artificial satellites and chunks of space debris are held in terrestrial orbit by gravity but are not sufficiently close to be parts of it What is part of the Earth is vague at the margins at any time, but the unclear parts are insignificant in bulk and/or in duration of their unclear status in comparison with the clear cases The welding relation is probably the same as or similar to that of a pebble Neighborly bits of the Earth are not just proximate they exchange energy in various ways This correctly excludes as parts those many transient neutrinos which pass right through the Earth without interaction

IV 4 An Organism An organism such as a fly is a natural whole It is not only a coherent connected body, which moves with all its parts connected though varying in their configuration, but it is sustained and powered by a stratified hierarchy of processes which promote its coherence and survival from moment to moment These vital processes constitute its physiology and activity, and if they stop functioning, the fly dies Indeed the fly, as an enduring continuant, arguably exists and preserves its identity precisely because of the causal continuity and delimited unity of its constitutive vital processes Organisms are sufficiently adept at self-maintenance through changing circumstance that they constitute Aristotle's principal class of individual substances and van Inwagen's one accepted class of composite individuals

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[33] In larger nuclei nucleons may be too far apart to exchange gluons directly, but there will be a chain of gluon-exchange links between any two

[34] Particles are not in contact, so we cannot use contact as the defining relation I am reminded of the unofficial USAF definition of an aircraft, which is "a collection of parts flying in *very* close formation "

IV 5 An Explosion An explosion is an event consisting in a sudden increase in volume of some material accompanied by a violent release of energy Because causality is unidirectional, it is much easier to identify the onset of an explosion than to delimit its terminal boundaries, whether spatial or temporal an explosion is not crisply separated from its effects Nevertheless the welding relation obviously involves the many subevents and processes which constitute the rapid expansion of the material

IV 6 A Performance of a Symphony This is a spatiotemporally complex artificially generated event whose boundaries and unity are determined by the common aim and purpose of a group of people, the performers, to play precisely the symphony in question On the parts, see section v 5 below

V REAL PARTS

What count as parts of an individual? One natural thought is that a part is something which could survive on its own, separated from the rest of the whole, as a brick may survive when removed from a wall But not only is this circular—since we have to say the thing *is* a part of the other—it does not cover all cases, since some parts (dependent parts like tropes and boundaries) are ones which precisely *cannot* exist alone or survive separation The cardiovascular system of a mammal is a part which cannot survive alone, nor can it be separated, but it is a part nonetheless In the light of our rejection of maximalism, even if we can identify a collection of parts of some individual, they do not compose a further part unless they compose under a welding relation Not just any arbitrary sum of parts of a whole is itself a part This serves only to rule out certain cases For the same reason we cannot identify as a part of something just anything which occupies a subregion of the region occupied by the whole the occupants have to compose in their own right An arbitrarily jerrymandered subregion of the region occupied by a real whole, whether natural or artificial, continuant or occurrent, may be a genuine region, but it will not in general be occupied by *a* part of the whole Indeed in the case of the simplest objects it may be that the object occupies an extended region while *none* of the subregions occupied is the exact locus of a part of the whole, since the whole has no parts This radical disconnection of the mereology of regions from that of their occupants was upheld by Whitehead as well as the early Kant, and appears to me to be well justified [35] Since much of the plausibility of the doctrine of arbitrary parts of material or processual wholes derives from the harmlessness of arbitrary division and composition among regions, the rejection of the doctrine of simple occupation of a region by an object undercuts the credentials of standard mereology to represent the actual part-whole relations obtaining among real things

Once again, it appears that there is no formal recipe for delimiting the parts of a whole But as before, I believe there is a schema covering natural cases of parthood, particularly in the case of concrete spatiotemporal individuals A part of a concrete individual—whether continuant or occurrent—is something which plays a distinct, unified and identifiable causal or, more broadly, functional *role* within the individual or its life Not just any collection of parts compose such a part because they may not perform such a causal role For example, your left big toe and right thumb do not compose a part, whereas your bones and joints do (namely, your skeleton) This analysis is no more exact than the notion of a unified causal or functional role In other words it is not exact, but in this it mirrors how we actually delimit parts To explore the notion of role or function would take us too far afield here Instead, it is again instructive to look at actual examples

V 1 Parts of a Helium Nucleus These are the two protons and neutrons, and their parts in turn, the three quarks that make up each nucleon Each of the parts has its own distinctive causal role [36]

V 2 Part of an Organism The Heart A heart is a natural part of an animal The characteristic function of a heart—and for definiteness here we mean mammalian hearts—is to pump blood around the body deoxygenated blood from around the body flows through the veins to one of the four main chambers of the heart, the right atrium As the heart muscle relaxes a tricuspid valve between the right atrium and right ventricle opens allowing this blood to flow into the right ventricle When the heart muscle contracts the valve closes and blood is squeezed out of the right ventricle into the pulmonary artery, entering the lungs for oxygenation Oxygenated blood returning from the lungs enters the left atrium via the pulmonary vein, passes through the mitral or biscuspid valve into the left ventricle and on contraction is forced out at high pressure into the aorta from whence it circulates to the body To prevent backflow into the ventricles there are two semilunar valves The heart tissue is mainly muscle this is provided with its own blood vessels and nerves, which coordinate the rhythmic contractions or beats, whose rate is controlled by a variety of factors The heart is enclosed in a double-layered sac, the pericardium, the inner part of which is attached to the outer layer of the heart and the outer layer of which is attached to surrounding tissue, and between the layers of which is a lubricating fluid The pericardium is pierced by the inward and outward conducting blood vessels

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[35] Simons, "Extended Simples A Third Way between Atoms and Gunk," *The Monist*, LXXXVII (2004) 371–84

[36] Where we are unable to clearly separate causal roles, for example, in the quantum superposition of indiscernible particles, we cannot seriously talk of there being distinct individuals Cf my "Particulars in Particular Clothing "

Having described the principal parts of the heart and their main functions in sufficient detail for our purposes, we ask What makes the heart a unitary object? It is not simply its anatomical connectedness The upper thighs and pelvic region are also connected but do not compose a body part What warrants treating the heart as a single part is its pumping function This is not isolated the heart, though the principal part, is but one proper part of the circulatory pulmonary system Functionally, the primary entity is this system, but the heart drives the whole system mechanically by its pumping action, without which the animal dies very quickly The way the heart is composed, down to detail, is to facilitate this function that is how it has evolved over hundreds of millions of years The heart *qua* pump has to be hollow, and it is very complexly hollow, with the four chambers in two pairs, separated by the septum, valves between atria and ventricles, and hollow vessels leading in and out An account of the heart without mention of its cavities is fundamentally defective like a pipe or a cave or a dwelling, it is essentially hollow, and the cavities are among its principal features [37]

The heart does not have that kind of separation from its surroundings which characterizes some kinds of natural whole we have considered Its *raison d'être* lies not in being a separate individual but in playing a characteristic part in causally sustaining the life processes of an animal Functional unity is combined with anatomical togetherness, which is why the heart has been recognized as a vital part since antiquity even though its function was only understood much later

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[37] On the importance of cavities, see Roberto Casati and Achille Varzi, *Holes and Other Superficialities* (Cambridge MIT, 1994)

Note how little the account of the unity of the heart draws on the kinds of abstract consideration typically evoked in the discussion of composition principles earlier One may draw opposing conclusions from this fact One conclusion is that because the composition principles are indeed so general and abstract, they need take no lessons from the discussion of concrete cases, which pertain to material detail rather than formal ontology The contrapositive conclusion, which I uphold, is that because the abstract considerations are so far removed from actual cases, they cannot be taken as reliable guides to a realistic ontology of part and whole

V 3 Heartbeats and Their Parts The heart's activity is cyclical each cycle is a heartbeat, and as such is a natural part of the whole activity because it is temporally connected and causally distinct from adjacent beats Each heartbeat has two phases In the systolic phase, the ventricles contract, pumping blood into the arteries In the diastolic phase, the ventricles relax and blood flows into them from the atria Each phase also has two natural spatial parts, those relating to the two atria or ventricles respectively Further natural parts include the progressive pulses of neural activity which cause the heart's contraction In each case we can find causal and functional unity in the occurrent part concerned, at different levels of detail

V 4 Artefact Parts Parts of artefacts may be functional in the narrow sense of contributing specially to the working or use of the artefact, as, for example, a motor of an automobile, its wheels, its seats, its steering wheel They may also be assembly parts those manipulated as units in the manufacture of the artefact Often an assembly part is also a functional part, but not always The braking system of a train is not assembled separately but comes into being *in situ* A wing spar of an aircraft is a supporting piece for the wing, but it may have been manufactured out of separately milled assembly pieces welded together the individual segments of the wing spar count as parts during the assembly stage but lose that distinction and their status as parts once the wing spar is unitarily performing its supporting role Discrepancies among what are the parts of a complex artefact at different stages in its life cycle are actually a serious administrative problem for engineers tracking, documenting, updating and costing manufacture, maintenance and modification[38]

V 5 Parts of a Symphony's Performance There are two obvious ways in which a symphony's performance is naturally segmented into parts

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[38] On different kinds of artefact part and the problems of discrepancy, see Simons and Charles W Dement, "Aspects of the Mereology of Artifacts," in Roberto Poli and Simons, eds , *Formal Ontology* (Boston Kluwer, 1996), pp 255–76

The first is temporally the symphony is divided into movements, and each movement is divided into sections, bars, chords, and so on The performance is thus segmented in the same way The different temporal parts of the symphony, of greater or lesser length, correspond to vertically segmented sections through the score The second mode of segmentation is "horizontal," and corresponds to what are called the "parts" in standard musical parlance the first violin part, the second violin part, the first flute part, and so on These correspond in performance to the sum of all the organized sequences of sounds produced by all the members of one section of the orchestra, for example, the first violins, throughout the symphony's performance In any actual performance this is further naturally broken down into the part played by each individual player, when several players are playing the same part Though as specified by the score these should be invariant throughout faithful performances, they correspond to real parts of actual performances, requiring skill and effort to produce, as any orchestral player will personally testify Finally there are musically significant parts such as themes, melodies, tonal progressions, chords, and so on, the stock in trade of musicologists All these divisions and parts are unproblematic and accord with the idea of special causal and functional roles, even the purely temporal divisions, which not only do sound together, but (unlike say the temporal phases of a crowd's roar at a football game) are *designed* to do so by the composer

VI CONCLUSION

Mereology is an essential part of ontology, but it can easily be overused For instance, several important computer ontologies use only two formal relations among entities *is_a* and *part_of*[39] Even if these are interpreted sensibly,[40] this places far too much burden on mereology, not to mention inclusion, exemplification, or whatever *is_a* is supposed to represent Even formal ontology is a good deal richer than this But in particular it cannot be assumed that because the part-relation behaves in one way in one domain—in the ontology of spatiotemporal regions, say—that it must behave similarly elsewhere All that can be guaranteed *a priori* is that the part-concept has the formal characteristics which are analytic of it [41] When it comes to the honest toil of investigating the principles governing what objects are parts of others, and what collections of objects compose others, it appears that most ontologists have been following the paradigm of abstract algebra when it would have been better to take a lead from sciences such as geology, botany, anatomy, physiology, engineering, which deal with the real [42]

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[39] For example, the Gene Ontology http //www geneontology org

[40] That they usually are not is the justified complaint of Barry Smith, "Beyond Concepts Ontology as Reality Representation," in Varzi and Laure Vieu, eds , *Formal Ontology and Information Systems* (Amsterdam IOS, 2004), pp 73–84

[41] Simons, *Parts*, p 362

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[42] A mereologist who has remained quietly unfazed by algebra is David Sanford see his "The Problem of the Many, Many Composition Questions, and Naive Mereology," *Noûs*, xxvii (1993) 219–28, and "Temporal Parts, Temporal Portions, and Temporal Slices An Exercise in Naive Mereology," *Acta Analytica*, xv (1996) 21–33

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CAN MEREOLOGICAL SUMS CHANGE THEIR PARTS?[*]

Many philosophers think not. Many philosophers, in fact, seem to suppose that anyone who raises the question whether mereological sums can change their parts displays thereby a failure to grasp an essential feature of the concept "mereological sum." It is hard to point to an indisputable example of this in print,[1] but it is a thesis I hear put forward very frequently in conversation (sometimes it is put forward in the form of an incredulous stare after

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[*] I thank Achille Varzi for extensive comments on a draft of this paper, which have led to many revisions. I hope that he, like me, regards the revisions as improvements.

[1] One possible example is the section "Constitution and Mereology" (pp. 179–85) of Lynne Rudder Baker's *Persons and Bodies* (New York: Cambridge, 2000). I say "possible example" because much of what Baker says in this section I do not understand. But it does seem to me that what she says presupposes or implies that since a mereological sum "is identical with its parts," is "nothing over and above" its parts, it cannot change its parts: for it to change its parts would be impossible for a reason analogous to the reason for which it is impossible for Cicero to become identical with someone other than Tully. It seems, moreover, that she subscribes to the thesis that the concept of a mereological sum *is* the concept of an object that is identical with its parts or is nothing over and above its parts. I will not in this essay address the question whether a mereological sum is identical with its parts, is identical with the things it is a sum *of*. The thesis that a mereological sum is identical with its parts implies (in cases of mereological sums of more than one thing) that one thing can be identical with "two-or-more things" (not "individually," which everyone agrees is impossible—a violation of the principle of the transitivity of identity—but, as it were, collectively). In my view, this thesis is logically incoherent. For a discussion of this thesis and my reasons for thinking it logically incoherent, see my essay "Composition as Identity," in James E. Tomberlin, ed., *Philosophical Perspectives, Volume 8: Logic and Language* (Atascadero, CA: Ridgeview, 1994), pp. 207–20, reprinted in Peter van Inwagen, *Ontology, Identity, and Modality: Essays in Metaphysics* (New York: Cambridge, 2001), pp. 95–110. As to "nothing over and above its parts," as far as I can see, the phrase 'nothing over and above' is entirely meaningless.

A second possible example is chapter 6 ("Parts and Wholes") of Jonathan Lowe's *Kinds of Being: A Study of Individuation, Identity and the Logic of Sortal Terms* (Oxford, UK: Blackwell, 1989). I again say "possible example" because Lowe does not think that the objects he calls mereological sums *have* parts—at least not in the ordinary sense of 'part'. Consider the well-known case of Tibbles the cat, his tail ("Tail"), and "all of him but his tail" ("Tib"). According to Lowe, Tibbles is not only distinct from the sum of Tib and Tail (the two have different persistence conditions), but Tail is not a part of the sum of Tib and Tail—not, at least, in the sense of 'part' in which Tail is a part of *Tibbles*. If we say that Tib and Tail are *s-parts* of the sum of Tib and Tail ('s' for 'sum', 's-part' is my term, not Lowe's), then Lowe's position is that a sum cannot change its s-parts: in *that* sense, he contends that a mereological sum "cannot change its parts." And he regards this statement as a conceptual truth: someone who said that the mereological sum of Tib and Tail could cease to have Tail as an s-part would exhibit thereby a failure to grasp the persistence conditions associated with—and part of the meaning of—the sortal term 'mereological sum'.

And there is a second reason why I have said "possible example": I do not know what Lowe means by 'mereological sum'. He does not define the term and he explicitly

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I have said something that implies that mereological sums can change their parts)

I want to inquire into the sources of this conviction, and, by so doing, show that it is groundless

One of its sources, I think, is the apparently rather common belief that 'mereological sum' is, in its primary use, a stand-alone general term like 'unicorn' or 'material object'—a phase that picks out a *kind* of thing, a common-noun-phrase whose extension comprises objects *of a certain special sort*[2] (Or perhaps it is saying too much to say that this is a common *belief* I might say, more cautiously, that there seems to be common tendency to presuppose that 'mereological sum' is a stand-alone general term, or a common tendency to treat 'mereological sum' as a stand-alone general term)

On this understanding of 'mereological sum', there can be philosophical disputes about whether there are or could be mereological sums—as there are philosophical disputes about whether there could be unicorns or are material objects For example (on this understanding), 'mereological sum' might be defined as "object that is identical with its parts" or "object that is nothing over and above its parts" or "object that is nothing more than the sum of its parts "[3] And, once a definition of the general term 'mereological sum' has been given,

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rejects the definition used in the present essay (He sees clearly that, if 'mereological sum' is defined as it is defined in this essay, Tibbles *is* the mereological sum of Tib and Tail, and, as Lowe sees matters, that simply will not do, since, if Tail were surgically removed from Tibbles, Tibbles would continue to exist and would no longer have Tail as a part, and—as everyone knows—mereological sums cannot change their parts)

A final example in *Real Names and Familiar Objects* (Cambridge MIT, 2004), Crawford L Elder says (p 60), "An *aggregate* of microparticles is the mereological sum of individually specified microparticles It continues to exist just as long as *those* individual microparticles exist, and just where those individual microparticles exist " I am fairly sure that Elder thinks that it is a conceptual truth that if something is a mereological sum of certain microparticles, it will continue to exist just as long as those individual microparticles exist

[2] All the philosophers cited in the previous note would appear to believe that mereological sums are a special sort of object See the paragraph complete on p 183 of Baker's *Persons and Bodies* Lowe certainly believes that mereological sums are a special sort of object that that is so is a central thesis of his theory of parts and wholes Elder evidently regards 'aggregate' (or 'mereological sum') as a name for a kind of object, a kind that can contrasted with other kinds kinds comprising objects that do not bear the specified relation to "individually specified microparticles "

[3] I do not mean to imply that I regard these as adequate definitions An adequate definition, at a minimum, pairs a definiendum with a meaningful definiens, and these three definientia are entirely meaningless I have explained why I think that the first and the second of them are meaningless in note 1 As to the third—well, let us define a "dog" as an object that is nothing more than a dog There can be no adequate definition of mereological sum but the definition I shall give in the text (in section I)

philosophers can, as is their custom, proceed to dispute about whether there are or could be mereological sums in the sense of the definition

Philosophers who understand 'mereological sum' in this way will, however, concede that there is more to be said about the phrase, for they will be aware that 'mereological sum' has a use different from its use in sentences like 'The mereological sum sitting on that table is green' or 'All artifacts are mereological sums' 'Mereological sum' (they will be aware) is not used only as a stand-alone general term, since the phrase also occurs in *relational* statements like 'That statue is a mereological sum *of* certain gold atoms' and 'A mereological sum *of* a railway engine and any number of cars is a *train* when those objects are fastened to one another in a certain way' How shall those who understand 'mereological sum' as, in the first instance, a stand-alone general term define the relational phrase 'mereological sum of the so-and-sos'? Their answer to this question will have to be of the following general form 'x is a mereological sum of the so-and-sos if and only if x is a mereological sum and the so-and-sos x '—the second conjunct of the *definiens* being some condition on the so-and-sos and their relation to x This fact has a consequence that I find rather odd Presumably, the second conjunct would have to be something along the lines of 'the so-and-sos are all parts of x and every part of x overlaps at least one of the so-and-sos' (see section I, below)[4] But (according to those who believe that mereological sums are a certain special sort of object) the following story is at least formally possible Call the bricks that were piled in the yard last Tuesday the "Tuesday bricks " Between last Tuesday and today, the Wise Pig has built a house—the "Brick House"—out of the Tuesday bricks (using them all and using no other materials) The Brick House did not exist last Tuesday (that is, it was not then a pile of bricks, a thing that was not yet a house but would become a house) The Brick House is not, therefore, a mereological sum, for if it were, it would have been (it would have "existed as") a pile of bricks last Tuesday Because it is not a mereological sum, it is not (by the present definition) a mereological sum of the Tuesday bricks Nevertheless the following statement is true The Tuesday bricks are all parts of the Brick House and every part of the Brick House overlaps at least one of the Tuesday bricks. This seems to me to be a very odd result, since (it seems to me) 'a mereological sum of the Tuesday Bricks' is the obvious thing to call something of which the Tuesday Bricks are all parts and each of whose parts overlaps at least one of the Tuesday Bricks. Is this odd result—or is the apparent oddness of this result—perhaps a consequence of an illegitimate employment of tenses and temporal indices? In section III, we shall address the issues this question raises.

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[4] For if an object is a mereological sum of certain things, each of those things is—presumably—a part of that object But perhaps I should not say 'presumably' because at least one philosopher, Lowe, has denied this very thesis (see note 1) My excuse is that, as I have said, I do not know what Lowe means by 'mereological sum' Is not the purpose of applying the adjective 'mereological' to the noun 'sum' to distinguish one application of the word 'sum' from others ("arithmetical sum," "vector sum," "logical sum,")?, and does this application not have to do with 'parts' in the most literal sense of the word? Does '*merós*' not mean 'part'?

In my view, it is the philosophers who understand 'mereological sum' as a stand-alone general term who have failed to grasp an essential feature of the concept "mereological sum"—or, better, of the concept "mereological summation." The order of definition implicit in the correct understanding of mereological summation is this: one *first* defines '*x* is a mereological sum of the so-and-sos'. That is to say, the basic or fundamental or primary occurrence of 'mereological sum' is as a part of this longer phrase, a phrase that asserts that a certain relation holds between one object and a plurality of objects. Having given a definition of '*x* is a mereological sum of the so-and-sos' one can, if one wishes, proceed to define the stand-alone general term 'mereological sum' in terms of the relational phrase 'mereological sum of . . .'. And the definition that one will give (if one wishes) is obvious: "*x* is a mereological sum if and only if there are certain objects such that *x* is a mereological sum of those objects."

I will defend the following thesis: for every object *x* (or at least for every object *x* that has parts) there are objects such that *x* is a mereological sum of those objects. I will in fact defend the thesis that this statement is true by definition, a consequence of a correct understanding of mereological summation. And (if 'a mereological sum' is indeed no more than an abbreviation of 'an object that is, for certain objects, a mereological sum of those objects') it follows immediately that every object (that has parts) is a mereological sum. The phrase 'mereological sum' does not, therefore, mark out a special kind of object—or, at any rate, it marks out no kind more special than "object that has parts." (And, of course, if we so use 'part' that everything is by definition a part of *itself*, 'object' and 'object that has parts' coincide.) An immediate consequence of the correct conception of mereological summation is that 'mereological sum' is not a *useful* stand-alone general term. In this respect, 'mereological sum' is like 'part'. If everything is a part of itself, then the word 'part' does not mark out a special kind of object and 'part' is not a useful stand-alone general term—for 'a part' can be defined only as "an object that is a part of something," and every object is thus a "part." The case of arithmetical summation teaches the same lesson. It is *possible* to lift the word ‘sum’ out of the relational sentence ‘x is the sum of y and z’ and to use the word as a stand-alone general term—for example, ‘The number 17 is a sum’—but no purpose is served by doing so

Now if every object (every object that has parts, that has even itself as a part) is a mereological sum, every object that can change its parts is a mereological sum that can change its parts[5] And, since the statement “Some objects can change their parts” involves no conceptual confusion, neither does the statement “Some mereological sums can change their parts ” I grant that if every object is a mereological sum, it may nevertheless be that no mereological sum can change its parts—because no *object* can change its parts But what is *not* true (I shall contend) is this to speak of a mereological sum changing its parts is to misapply the concept “mereological sum ”[6] And, of course, if every object is a mereological sum, it is not true that although some objects can change their parts, no mereological sum can change its parts

I EVERYTHING IS A MEREOLOGICAL SUM

Let us set out formally the definitions of ‘mereological sum of’ and ‘mereological sum’ (*tout court, simpliciter*) that were anticipated in the above introductory remarks Our primitive mereological term will be ‘is a proper part of’ We begin with two preliminary definitions

x is a part of $y =_{\mathrm{df}} x$ is a proper part of y or $x = y$
x overlaps $y =_{\mathrm{df}}$ For some z, z is a part of x and z is a part of y

Our definitions of ‘mereological sum of’ and ‘mereological sum’ will make use of the following logical apparatus plural variables, the relational phrase 'is one of', and (in the second definition) a plural quantifier[7] (An alternative would have been to use only ordinary "singular" variables and to quantify over sets)

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[5] An object can change its parts only if it persists through time In this paper, I will presuppose an “endurantist” or “three-dimensionalist,” as opposed to a “perdurantist” or “four-dimensionalist,” view of persistence through time For my views on the endurantist-perdurantist controversy, see my essays “The Doctrine of Arbitrary Undetached Parts,” *Pacific Philosophical Quarterly*, LXII (1981) 123–37, “Four-dimensional Objects,” *Noûs*, XXIV (1990) 245–55, and “Temporal Parts and Identity across Time,” *The Monist*, LXXXIII (2000) 437–59 All three essays are reprinted in *Ontology, Identity, and Modality*

[6] Suppose that the very idea of a thing's changing its parts is conceptually incoherent, that “mereological essentialism” is an analytic or conceptual truth Would that not entail that “to speak of a mereological sum's changing its parts is to misapply the concept ‘mereological sum’”? Well, no doubt—but only in a very strict and pedantic sense of “misapplying the concept ” It would also be true, in this strict and pedantic sense, that to speak of a cat's losing its tail was to misapply the concept “cat ” The person who said, “That cat has lost its tail” or “That cat is composed of different atoms from the atoms that composed it last week,” would not, in the case imagined, be making a conceptual mistake *peculiar to* the concept “cat ” That person's conceptual mistake is better located in his or her application of the concepts “part” and “change ” And so for the person who said, “That object is this week a mereological sum of different atoms from the atoms of which it, that very object, was a mereological sum last week ” We shall consider this question—the question whether it is conceptually coherent to suppose that any object can change its parts—in section IV

> x is a mereological sum of the ys $=_{\text{df}}$ For all z (if z is one of the ys, z is a part of x) and for all z (if z is a part of x, then for some w, (w is one of the ys and z overlaps w)) [8]

Informally the ys are all parts of x, and every part of x overlaps at least one of the ys The first clause of the definiens tells us (speaking very loosely) that the ys are not too inclusive to compose x, and the second that they are not insufficiently inclusive to compose x[9] Finally,

> x is a mereological sum $=_{\text{df}}$ For some ys, x is a mereological sum of those ys

We now show that for any x, there are ys such that x is a mereological sum of those ys It will suffice to show that any object x is a mereological sum of its parts The proof is trivial we simply substitute 'the parts of x' for 'the ys' in the definition of 'mereological sum of' (Or substitute 'the ys such that $\forall z$ (z is one of those ys $\leftrightarrow$ z is a part of x)'[10]) Inspection of the result of making this substitution will make it plain that x is a mereological sum of the parts of x—provided that x *has* parts (Presumably, x is a mereological sum of the parts of x only if x has parts, as a woman is a daughter of her mother only if she has a mother) But everything has parts itself if no others Therefore, x is (without qualification) a mereological sum of the parts of x (It is also easy to show—by a trivial variation on this argument—that if a thing has proper parts, it is a sum of its proper parts)

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[7] For an exposition of this apparatus, see van Inwagen, *Material Beings* (Ithaca Cornell, 1990), pp 23–28

[8] This definition presupposes that if x is a proper part of y, y has at least one part that does not overlap x Thus, it is not possible, for example, for an object to have exactly two parts, itself and one proper part If this were possible, the definition would imply that such an object was a mereological sum of the things identical with its proper part

[9] We define '*a* mereological sum of the ys' rather than '*the* mereological sum of the ys' because we wish to leave it an open question how many mereological sums two or more objects may have At least some advocates of the popular thesis that "the gold statue is distinct from the lump of gold" might wish to express their thesis this way certain gold atoms have two mereological sums, one of which is a gold statue and the other of which is a lump of gold The two axioms of Leśniewski's "mereology" are Parthood is transitive, For any ys, those ys have ***exactly one*** mereological sum We should ***not*** think of mereological summation in the following way mereological summation is, by definition, the relation having the properties ascribed to the relation called "mereological summation" by the theory of parts and wholes called "mereology " Rather, we should think of "mereology" as a theory that ascribes certain properties to the relation of mereological summation, a relation of which we have a definition that is independent of the axioms of mereology Other, competing, theories of parts and wholes (for example, "nihilism," the theory whose sole axiom is "Nothing has any proper parts", one "theorem" of nihilism is that the only mereological sums are metaphysical simples, each of which is a mereological sum of the objects identical with itself) ascribe different properties to mereological summation from those ascribed to this relation by "mereology"—in the very same sense of "mereological summation "

[10] The expressions 'the parts of x' and 'the ys such that $\forall z$ (z is one of those ys $\leftrightarrow$ z is a part of x)' are (open) ***plural definite descriptions*** Cf the closed plural definite descriptions 'the presidents of the U S ' and 'the xs such that $\forall y$ (y is one of those xs $\leftrightarrow$ y is a president of the U S)'

Here is a second argument for the conclusion that for any x, there are ys such that x is a mereological sum of those ys A straightforward "substitution" argument similar to the argument of the preceding paragraph shows that any object x is a mereological sum of the things identical with x (of the ys such that $\forall z$ (z is one of those ys $\leftrightarrow z = x$)) [11]

Everything, therefore, has this feature there are objects (its parts, the things identical with it) such that it is a mereological sum of those things [12] And this is just our definition of 'is a mereological sum' Everything is therefore a mereological sum

II WHERE DOES THE MODALITY COME FROM?

If "A mereological sum cannot change its parts" is a conceptual truth, it must be that "mereological sum" is a modal concept, or at least a concept that has some sort of modal component But (one might want to ask) how could that be? As we have seen, 'mereological sum' can be defined in terms of 'part of', and parthood does not seem to be a modal concept—or even a concept that "has some sort of modal component " On what basis, then, can someone who holds that mereological sums can change their parts be accused of some sort of conceptual mistake?

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[11] Is mereological summation unique in these two cases at least? Can we say that everything is *the* mereological sum of its parts and *the* mereological sum of the things identical with it? That depends Developments of mereology often define identity as mutual parthood But suppose that one did not assume that a plurality of objects had at most one mereological sum, that one also regarded '=' as a primitive—a purely logical symbol—and, finally, that one did not adopt as a mereological axiom the thesis 'If x is a part of y and y is a part of x, then $x = y$' In that case it would be formally possible to say that, for example, the gold statue and the lump of gold are each parts of the other and yet numerically diverse If these *two* objects, the statue and the lump, are indeed parts of each other, the statue is a mereological sum of the parts of the lump, and the lump is a mereological sum of the things identical with the statue

[12] Typically, of course, objects will also be mereological sums of "other things" than their parts and the things with which they are identical The gold statue, for example, is a mereological sum of certain gold atoms—just those gold atoms that are parts of it (let us suppose that there are more than two of them) If two among those gold atoms have a mereological sum X, then the statue is a mereological sum of X and the atoms that are not parts of X And X and the atoms that are not parts of X are not identical with the parts of the statue—owing to the fact that the two atoms that make up X are both parts of the statue, but neither of those two atoms is one of X and the atoms that are not parts of X (We say that the xs *are identical with* the ys just in the case that everything that is one of the xs is one of the ys and everything that is one of the ys is one of the xs)

A question is not an argument, however, and it would be possible to reply to this question by pointing out that an exactly parallel question could be addressed to someone who maintained that it was impossible for sets to change their members and who contended that anyone who thought that sets could change their members was a victim of conceptual confusion And (the reply might continue) the parallel question would have no power to undermine the conviction—certainly a conviction that many philosophers have—that it is impossible, conceptually impossible, for sets to gain or lose members Let us explore this parallel

Many philosophers have convictions about the modal properties of sets, and the conviction that a set can neither gain nor lose members is one of the most prominent of them I myself share this popular conviction Consider, for example, my two dachshunds, Jack and Sonia I have my doubts about the existence of sets (I incline toward something like a "no-class theory" elimination of sets from my ontology), but I am certainly convinced that if there is such an object as {Jack, Sonia}, it must have exactly the two members it does—at any time, and, what is more, in any possible world (Perhaps it somehow exists outside time In that case, it certainly can not gain or lose members And, even in that case, I am convinced that it does not have other members in other possible worlds If it exists "in time," then, I am convinced, it exists when and only when both Jack and Sonia exist Thus, if Sonia, say, ceases to exist, then {Jack, Sonia} also ceases to exist—and at very moment Sonia ceases to exist)

What is the source of these convictions? It is hard to see how they could have their source in "official set theory"—that is, in the theory of sets as it is presented in a book like Paul Halmos's *Naive Set Theory* (or as it is presented in a book like W V Quine's *Set Theory and Its Logic*, which is particularly sensitive to philosophical questions raised by set theory) Let us separate cases these convictions are either without basis in reality, or they have some basis in reality In the former case, the analogy with sets is of no interest to us In the latter case, we may ask what kind of basis in reality they have I cannot see what basis they could have but some sort of "intuition" of the objects that set theory is about Godel has famously, or infamously, said that the axioms of set theory "force themselves upon the mind as true " If that is so, perhaps there are other propositions about sets that force themselves upon the mind as true—other propositions than those that would be of interest to a mathematician whose only interest in set theory is as a tool to be used in "real" mathematics (Halmos), or to a philosopher who regards all questions about the necessary or essential features of things as misplaced (Quine) If the power-set axiom

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can force itself upon the mind as true, perhaps the proposition that sets cannot change their members can also force itself upon the mind as true.[13] Perhaps it *must* force itself upon the mind of anyone who grasps the concept "set" and who so much as considers the question whether sets can change their members. I will not try to develop this suggestion. I will only point out that if it is correct, this must be because human beings somehow have an intuition of (some sort of immediate intellectual access to) sets, to objects of a certain *sort*, to those *special* objects of which set theory treats. And, if that is so, the statement "Mereological sums cannot change their parts" and the statement "Sets cannot change their members" are in no way analogous. They are in no way analogous for the simple reason that, as we have seen, mereological sums are not a special sort of object. Although not everything is a set, everything is a mereological sum. 'Set' is a useful stand-alone general term. 'Mereological sum' is not a useful stand-alone general term. Perhaps human beings have "intuitions" about sets, perhaps our intuitive knowledge of sets somehow reveals to us that sets cannot change their members. Perhaps. What is certainly not the case is that human beings have intuitions about mereological sums—because there is no such thing as having intuitions about mereological sums. At any rate, there is no such thing unless it is having intuitions about parthood or about objects with parts.[14] Some among us may claim to have the following "intuition" about objects with parts: an object with parts cannot change its parts. (In section IV, I will consider an argument that might be thought of as an attempt to make explicit the considerations on which this intuition rests.) This intuition may even be right. I think it is wrong, but perhaps *I* am wrong. What I am certain I am not wrong about is this: whether objects can change their parts or not, the intuition that objects cannot change their parts is not an intuition about mereological sums, it is, rather, an intuition about objects-in-general

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[13] Could the conviction that sets cannot change their members be due to nothing more than the axiom of set theory that provides the principle of identity for sets: *x* is identical with *y* if and only if *x* and *y* have the same members? I do not think so. Suppose there were actually someone thought that sets could change their members. Such a person, surely, would contend that, owing to the fact that set membership can vary with time, the phrase 'have the same members' was ambiguous—that this phrase could mean 'now have the same members', 'sometimes have the same members', or 'always have the same members'. The following statement (he would further contend) is the proper principle of identity for sets: *x* is identical with *y* if and only if *x* and *y* *always* have the same members. We shall return to the topic of temporal qualification of set membership in the next section.

[14] Professor Varzi has pointed out to me that in note 8 I have appealed to an intuition about mereological summation: that an object cannot be a mereological sum of the things identical with its sole proper part. But this case nicely illustrates my point. The "intuition" I appeal to there can be described as an intuition about mereological sums, but it can also be described as an intuition about parthood: that if *x* is a proper part of *y*, then *y* has at least one part that does not overlap *x*.

Granted a question is not an argument But neither has our question—Where does the modality come from?—been answered

III TEMPORAL QUALIFICATION

"The fact that sets cannot change their parts (or at least the fact that that is the way everyone who uses set theory looks at sets) is reflected in the fact that set membership cannot be temporally qualified It is a plausible thesis that expressions like '∈ on December 11th, 2005' are meaningless It is certainly true that the official language of set theory affords no syntactical opportunity to attach temporal adverbs (or adverbs of any sort) to '∈' And even if temporal qualification of set membership is meaningful (even if sentences like 'Sonia ∈ on December 11th, 2005 {Jack, Sonia}' have truth values), it would *have a point* only if at least some sets could (in at least some circumstances) change their members The fact that '∈' cannot be temporally qualified—the fact that no one has so much as proposed a version of set theory that permits temporal qualification of set membership—shows that everyone who makes use of set theory simply *takes it for granted* that sets cannot change their members

"And the same point, *mutatis mutandis,* holds for mereology The syntax of a formal mereological theory affords no opportunity to attach adverbs (temporal or otherwise) to 'is a part of' or 'overlaps' or to whatever its primitive mereological term may be If a formal mereological theory takes parthood as primitive, this relation will be represented by an expression like '$\mathrm{P}x,y$'—and not '$\mathrm{P}x,y,t$' or '$\mathrm{P}x,y$ at t' or '$\mathrm{P}_t\, x,y$' Does this fact not show that everyone who makes any use of mereological reasoning simply takes it for granted that parthood requires no temporal qualification—takes it for granted that temporal qualification of parthood is either meaningless, or is, if not meaningless, pointless, since, in every case, if x is a part of y at any time, x is a part of y at every time (at which y exists)? And if the temporal qualification of parthood is meaningless or pointless, must the temporal qualification of mereological summation, which—as you have pointed out—is definable in terms of parthood, not also be meaningless or pointless?"

Whatever may be the case with set theory, I should say that the alleged fact about formal mereological theories is a fact only about *certain* formal mereological theories It is indeed true that the inventor of "mereology" (the formal theory of that name) and the inventors of "the calculus of individuals" took it for granted that temporal qualification of parthood was either meaningless or pointless. But, as we have seen, there are other mereological theories, theories inconsistent with and in competition with mereology and the calculus of individuals. The proponents of at least one of these theories—nihilism—will agree with Stanisław Leśniewski and with Henry Leonard and Nelson Goodman on this point. (If the only part a thing can have is itself, temporal qualification of parthood is at best pointless.) But what of those philosophers who do think that at least some things *can* change their parts? What of Judith Jarvis Thomson, for example, who has said, "It is really the most obvious common sense that a physical object can acquire and lose parts. Parthood surely is a three-place relation, among a pair of objects and a time."[15] And what of *me*?—for I think that lots of the atoms that were parts of Sonia at noon yesterday are not parts of her today. We shall maintain that *of course* one cannot say what one needs to say to describe the relations of things to their parts without making use of some expression along the lines of 'x is at t a part of y'. We shall contend that the verbs in the above definition (in section I) of 'mereological sum of' must be understood as being in the present tense. We shall say that this definition is, in effect, a definition of what it is for x *now* to be a sum of the ys. We shall say that this definition should be subsumed under the more general definition:

> x is at t a mereological sum of the ys $=_{\text{df}}$ For all z (if z is one of the ys, z is at t a part of x) and for all z (if z is at t a part of x, then for some w, (w is one of the ys and at t z overlaps w)).[16]

Having given this definition, we shall affirm the following general thesis:

> For all t, if x exists at t, there are ys such that, x is at t a mereological sum of those ys.

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[15] Thomson, "Parthood and Identity across Time," this JOURNAL, LXXX, 4 (April 1983): 201–20, reprinted in Michael Rea, ed., *Material Constitution: A Reader* (Lanham, MD: Roman and Littlefield, 1997), pp. 25–43. The quoted sentences are on p. 36 of the reprint.

[16] Do expressions of the form 'x is one of the ys' also require temporal qualification? Is, for example, Jane one of Tom and Jane at a time at which (Jane exists and) Tom does not exist? A similar question can be asked about the quantifiers, both singular and plural. Should quantification over things that can begin to exist and cease to exist be temporally restricted?—Should we perhaps be using quantifier phrases like 'for some x that exists at t' and 'for all xs that there are at t'? I shall assume that such qualifications are not necessary—for no better reason than the fact this assumption reduces the complexity of the expressions I have to write out and the reader has to parse. If the qualifications are indeed needed, they can be inserted at the appropriate places and doing so will have no consequences for the arguments I shall present.

(Since, if x exists at t, x is at t a mereological sum of the things that are at t parts of x, and of the things with which x is identical [17])

We shall say that the strictly correct form of the (more or less useless) definition of 'mereological sum' (as a stand-alone general term) would be

> x is at t a mereological sum $=_{\text{df}}$ For some ys, x is at t a mereological sum of those ys

Having given this (more or less useless) definition, we shall affirm the following thesis

> For all t, if x exists at t, x is at t a mereological sum

(Since, if x exists at t, there are things of which it is at t a mereological sum) Because we affirm this thesis—and affirm that if x is a mereological sum at t, x exists at t—, we may offer an equivalent but simpler definition of 'x is at t a mereological sum' "x exists at t" And, if we like, we can drop the qualification 'at t' by defining 'a mereological sum' as a thing that is a mereological sum whenever it exists

Let us see how these definitions and these theses apply in a particular case, the case of the Wise Pig, the Tuesday Bricks, and the Brick House When this case was introduced, we assumed that the Brick House did not exist on Tuesday (That is, we assumed that the thing that is today a house composed of bricks was *not anything* on Tuesday—not a pile of bricks, not an "aggregate" of bricks, not anything) We now make one further assumption Earlier today, the Brick House lost a part (a brick, in fact), owing perhaps to some truly extraordinary pneumatic exertion of the Wolf's That is, there is a moment t such that the Brick House existed both before and after t and a certain brick (we will call it the Lost Brick, although, of course it was not lost before t) was a part of the Brick House before t and was not a part of the Brick House after t (In all these "set-up assumptions," the concepts of number and identity are to be understood in their "strict and philosophical sense" the Brick House is not to be thought of as an *ens successivum*,[18] some of whose earlier "momentary stand-ins" had the Lost Brick as a part and some of whose later momentary stand-ins did not.)[19]

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[17] I shall assume that identity requires no temporal qualification (cf note 16) That is, I shall assume that the formal, logical relation that goes by the name 'identity' requires no temporal qualification If one (unwisely, in my view) decided to call some other, nonlogical relation "identity"—the relation "having the same parts," perhaps—one might well find it necessary to attach temporal qualifications to identity (so called) "the statue and the lump were identical on Monday, but not on Tuesday "

[18] I have borrowed this medieval term (and some related terminology) from Roderick M Chisholm's voluminous writings on parthood and identity across time See, for example, chapter 3 of *Person and Object* (La Salle, IL Open Court, 1976)

If the set-up assumptions are granted, the Brick House is a mereological sum that loses a part. In the story, there is an object x such that for a certain interval before t, x was a mereological sum of the Tuesday Bricks and, for a certain interval after t, x was a mereological sum of "the Tuesday Bricks minus the Lost Brick."[20]

"But the Brick House was not the *same* mereological sum before and after the Lost Brick ceased to be a part of it."

Well, it was not a mereological sum of the *same things*. But that does not mean that it "wasn't the same mereological sum." What, in fact, *does* that phrase mean? It certainly does not wear its sense on its sleeve. Suppose it means this:

> x is the same mereological sum as $y =_{df} x$ is a mereological sum and y is a mereological sum and $x = y$.[21]

If we so define 'same mereological sum'—and how *else* could we understand this phrase?—then the thing that was before t a mereological sum of the Tuesday bricks *is* the same mereological sum as the thing that was after t a mereological sum of the Tuesday Bricks minus the Lost Brick. (Given that the two definite descriptions in this sentence are proper. If we wish to leave open the possibility that either the Tuesday Bricks had more than one mereological sum before t or the Tuesday Bricks minus the Lost Brick had more than one mereological sum after t, we shall have to say this:

> *Something* that was before t a mereological sum of the Tuesday bricks *is* the same mereological sum as something that was after t a mereological sum of the Tuesday Bricks minus the Lost Brick.

And this will certainly be true, for the Brick House was before t a mereological sum of the Tuesday bricks and was after t a mereological sum of the Tuesday Bricks minus the Lost Brick. And the Brick House is the same mereological sum as the Brick House—since it is a mereological sum and identical with the Brick House.)

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[19] Readers of *Material Beings* will know that the story of the Brick House and the Lost Brick is not a story that *I* regard as a possible case of the loss of a part. But at least some philosophers think (they think this even when they are in the philosophy room) that there are brick houses and that it is possible for a brick to be a part of one of them at one time and not at another. The only function of the story is to provide a particular, visualizable case that illustrates the consequences of certain definitions and theses.

[20] That is, a mereological sum of the xs such that $\forall y$ (y is one of those xs $\leftrightarrow$ y is one of the Tuesday Bricks and y is not the Lost Brick).

[21] Either the first or the second conjunct of the *definiens* is of course redundant, being a logical consequence of the other two conjuncts.

This case illustrates what it is for a mereological sum to change its parts for something to be, for some *x*s, a mereological sum of those *x*s at one time and (to exist and) not be a mereological sum of *those x*s at another time And this is a necessary feature of anything that gains or loses a part (and continues to exist)

"But the Brick House before *t* is not identical with the Brick House after *t*, since they have different parts " You might as well say that yourself before dinner is not identical with yourself after dinner, since they have different *properties* (the former is hungry and the latter is not, for example) [22]

Are we—we who say these things—conceptually confused? Only if our conviction that that there are things that can change their parts is evidence of conceptual confusion, for everything we have affirmed follows from this conviction

IV CAN *OBJECTS* CHANGE THEIR PARTS?

"A mereological sum cannot change its parts because nothing can change its parts (I concede that we *talk* as if objects could change their parts But such talk is misleading Insofar as there is anything right in what we say when we say that, for example, a table can change its parts, it can be perspicuously expressed in terms of the table's being an *ens successivum* that is constituted by a succession of 'temporary table-stand-ins' whose parts differ)

"Some people who hold the mistaken view that objects can change their parts compound their error with a further error they believe that some objects—mereological sums—cannot change their parts, and that other objects (some or all objects that are not mereological sums) *can* change their parts You have shown that this 'further error' is indeed an error—because (if one insists on treating 'mereological sum' as a stand-alone general term) everything is necessarily a mereological sum But you are guilty of the same fundamental metaphysical error as they, namely the error of supposing that it is possible for any object to change its parts And your error is a product of conceptual confusion the confusion that arises from treating *entia successiva* as real, persisting things and not as what they are useful fictions, logical constructs on their temporary stand-ins It is the temporary table-stand-ins, not the tables, that are the real, persisting things (although—physics teaches us—they generally persist only for minute fractions of a second) "

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[22] The Interlocutor's protest turns on a fallacy I have called "adverb pasting " See "Temporal Parts and Identity across Time" (cited in note 5) for an account of this fallacy

But why is it supposed to be impossible for objects to change their parts? I know of only one argument for this conclusion[23] I shall present it in the form of an argument for the impossibility of an object that has a small number of parts losing one of these parts, but the argument could easily be generalized to apply to an object with any number of parts, and to cases in which an object supposedly gains a part, both loses and gains a part, loses many parts and gains many parts, loses all its parts and acquires a wholly new complement of parts ("undergoes a complete change of parts")

Let us use '+' to express unique mereological summation (that is, use '$x + y$' to mean "the mereological sum of x and y") (The argument, as I shall present it, treats expressions formed by the use of '+' as definite descriptions Although I have been careful not to assume that mereological summation is necessarily unique, I am in fact willing to grant that, for any *x*s, those *x*s have at most one mereological sum It would be possible to construct a rather more elaborate version of the argument that did not presuppose that mereological summation was unique, an argument whose presuppositions were consistent with, for example, the thesis that the gold statue and the lump of gold are, at a certain moment, two distinct mereological sums of certain gold atoms What I should have to say about the more elaborate argument would not differ in any important respect from what I shall have to say about the argument that follows) Here is the argument

> Consider an object α that is the mereological sum of A, B, and C (that is, $\alpha = A + B + C$) We suppose that A, B, and C are simples (that they have no proper parts), and that none of them overlaps either of the others And let us suppose that nothing *else* exists—that nothing exists besides A, B, C, A + B, B + C, A + C, and A + B + C Now suppose that a little time has passed since we supposed this, and that, during this brief interval, C has been annihilated (and that nothing has been created *ex nihilo*) Can it be that α still exists? Well, here is a complete inventory of the things that now exist A, B, and A + B And α is none of these three things, for, before the annihilation of C, they existed and α existed and α was not identical with any of them (all three of them were then proper parts of α) And nothing can become identical with something else $x \neq y \rightarrow \Box\, x \neq y$, a thing and another thing cannot become a thing and itself We do not, in fact, have to appeal to any modal principle to establish this conclusion, for if α were (now) identical with, say, A + B, that identity would constitute a violation of Leibniz's Law, since the object that is both α and A + B would both have and lack the property "once having had C as a part "

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[23] See, for example, Chisholm, *Person and Object*, Appendix B, "Mereological Essentialism "

This argument is not without persuasive power As I have pointed out elsewhere, however, whether it is sound or not, it has two presuppositions or implicit premises that the friends of mereological change will question

> Before the annihilation of C, A and B had a mereological sum
>
> If A and B had a unique mereological sum before the annihilation of C, and if A and B had a unique mereological sum after the annihilation of C, the object that was their sum before the annihilation of C and the object that was their sum after the annihilation of C are identical

I will consider only the first of these questionable premises If this premise is not true, there is no reason one should not say—no reason provided by the argument, at any rate—both that before the annihilation of C, α was the mereological sum of A and B and C, and that after the annihilation of C, α was the mereological sum of A and B

Why should the friends of mereological change (or anyone) accept this premise? Presumably, one is supposed to accept the thesis that A and B had a mereological sum before the annihilation of C because this thesis is a consequence of a general principle concerning the existence of mereological sums

> For any *x*s, if those *x*s exist at *t*, those *x*s have at *t* at least one mereological sum

Or, since we are supposing that any *x*s have at any time at most one mereological sum, we may state the principle in this form

> For any *x*s, if those *x*s exist at *t*, those *x*s have at *t* a unique mereological sum

In "The Doctrine of Arbitrary Undetached Parts,"[24] I explained why I reject this principle if certain cells or simples have a living organism as their mereological sum at a certain moment, there will be some among them that do not, at that moment, have a mereological sum (For example, those among them that, if they composed anything, would compose "all of the organism but one of its appendages ")[25]

To say this much is not to have shown that any of the premises or presuppositions of the argument I am considering is false It is to show that the argument rests on the above principle concerning the existence of mereological sums.[26] (At any rate, I do not see why someone who did not accept this general principle would be certain that, in the very abstractly described case that the argument considers, A and B had a mereological sum before the annihilation of C.[27]) I see no reason to suppose that this principle is a conceptual truth. (It is, after all, a thesis that asserts—conditionally, to be sure—the *existence* of something. It entails that if two objects exist at a certain time, then a third object also exists at that time.) I therefore see no reason to suppose that "An object cannot change its parts" is a conceptual truth. And since, as I have pointed out, everything is a mereological sum, I see no reason to regard "A mereological sum cannot change its parts" as a conceptual truth.

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[24] Cited in note 5

[25] I also explained why I regard it as evident that there are things that can change their parts Descartes—whom I take to have been a living organism—could have persisted through the loss of a leg (that is, he could have persisted through an episode in which a great many cells or simples that had been parts of him ceased to be parts of him)

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[26] It will also rest on some principle that supports the second implicit premise. What might this principle be? The most obvious candidate is this:

> If the *x*s have a mereological sum at both t_1 and t_2, the object that is their mereological sum at t_1 is identical with the object that is their mereological sum at t_2.

In my view, the following case shows that this principle is false, or, at best, accidentally true: it is possible that certain atoms had a fish as their sum four million years ago and have a cat (not identical with the fish, not the fish "in another form") as their sum today. But there may be other, weaker, principles that support the second implicit premise.

[27] Suppose that, with respect to some less abstractly described case, someone had a *special* reason for thinking that A and B had a sum before the annihilation of C—a reason that depended on the properties and the mutual relations the case ascribed to A and B. That person *would* have to suppose that (in that case) A + B + C did not survive, and could not have survived, the annihilation of C—*unless* he or she was willing to say that the sum of A and B after the annihilation of C was a different object from the sum of A and B before the annihilation of C (that is, that, for some *x*, *x* was the sum of A, B, and C before the annihilation of C, and *x* was the sum of A and B after the annihilation of C—the object that was the sum of A and B before the annihilation of C having ceased to exist).

CONFINING COMPOSITION*

It is a choice that only some of us will have to make, but enough of us to make it worthy of some serious attention The puzzle I intend to address has generated a small literature, the finest piece of which I think is Gideon Rosen's masterful article, "Armstrong on Classes as States of Affairs "[1] There is no need to reinvent the wheel, but some need to display it In four moves, then, here is a slightly generalized version of Rosen's discussion followed by a presentation of the main argument forcing the surprising choice upon those of us sympathetic to the relevant background assumptions

I A SURPRISING CHOICE OR ONTOLOGICAL INNOCENCE UNMASKED

First Move Consider three controversial but popular metaphysical theses Apart from a few passing remarks about their plausibility, we need not enter into the history of or the current debate on these claims Instead it will suffice to identify a common feature that will prove essential to our puzzle, a feature that our three representative theses share with an even larger family of rather attractive metaphysical positions

(T1) Each object has a haecceity
(T2) Each object is the subject of an exemplification fact
(T3) Each object has a singleton

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[1] Rosen, "Armstrong on Classes as States of Affairs," *Australasian Journal of Philosophy*, LXXIII (1995) 613–25, a response to D M Armstrong, "Classes are States of Affairs," *Mind*, C (1991) 189–200 For related discussion, see Armstrong, "Reply to Rosen," *Australasian Journal of Philosophy*, LXXIII (1995) 626–28, John Bigelow, "God and the New Math," *Philosophical Studies*, LXXXIV (1996) 127–54, and *The Reality of Numbers* (New York Oxford, 1988), Peter Forrest and Armstrong, "The Nature of Number," *Philosophical Papers*, XVI (1987) 165–86, Hud Hudson, *A Materialist Metaphysics of the Human Person* (Ithaca Cornell, 2001), David Lewis, *Parts of Classes* (Cambridge Blackwell, 1991), and "Comment on Armstrong and Forrest," *Australasian Journal of Philosophy*, LXIV (1996) 92–93, Alex Oliver, "The Metaphysics of Singletons," *Mind*, CI (1992) 129–40, Gabriel Uzquiano, "The Price of Universality," *Philosophical Studies* (forthcoming)

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The term 'object' in these theses is to be taken in the most neutral sense possible—whether concrete or abstract, individual or class, thing, or stuff

Consider (T1), an alleged example of which is that my dog, Brody, exemplifies Brodyness For our purposes, we may say that property *P* is a haecceity of object *x* just in case *x* has *P* essentially, and necessarily, anything that has *P* is *x* Reasons to believe (T1) include its falling out of a robust theory of properties reigned in only by heterological-like contradictions, giving the Presentist a way of explaining truths such as 'Warren admires Socrates', providing the proponent of the Identity of Indiscernibles a response to Max Black's iron spheres, and furnishing a subject for those perplexing negative existentials

Consider (T2), an alleged example of which is Brody's being black An exemplification fact is a structured entity that has as constituents the object that is its subject and some property exemplified by the object Significantly, an exemplification fact is not identical to its subject nor is it identical to the mereological fusion of its subject and the relevant property (a fusion which may exist even in the absence of exemplification) Rather an exemplification fact is a third entity—a fact or event or particularized state of affairs—one of whose main jobs is to serve as a truthmaker for a corresponding proposition In the case of our alleged example above, the corresponding proposition is simply 'Brody is black' One need not be so liberal as to accept a general truthmaker principle to accept (T2), any restricted truthmaker principle which furnishes us at least one such fact for each thing will do

Consider (T3), an alleged example of which is SingletonBrody An object's singleton is just the unique class whose only element is that very object Naively, once we take ourselves to understand membership and are accustomed to recognizing singletons in ZF set theory, it is easy to work up a prejudice in favor of (T3) Otherwise how should we explain the mysterious divide between the members and the nonmembers?

Second Move Since Peter van Inwagen's *Material Beings*, the Special Composition Question has been center stage in contemporary analytic metaphysics [2] (That is, What is a true and illuminating way to fill in the blank in this schema?—'Necessarily, for any *x*s, there exists a *y* such that *y* is a fusion of the *x*s iff __________ ') Despite respectable opposition, the view becoming (if not already) the orthodoxy among those writing in mereological metaphysics is that composition is absolutely unrestricted, any plurality whatever has a mereological sum or fusion. Treating parthood as a two-place relation, we may state this thesis of Unrestricted Mereological Composition as follows:

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[2] Van Inwagen, *Material Beings* (Ithaca Cornell, 1990) Also see Hudson, Lewis, *On the Plurality of Worlds* (New York Blackwell, 1986), Ned Markosian, "Brutal Composition," *Philosophical Studies*, xcii (1998) 211–49, Theodore Sider, *Four-Dimensionalism* (New York Oxford, 2001)

(UMC) Necessarily, for any *xs*, there exists a *y* such that *y* is the fusion of the *xs*.

Two quick confessions: (i) I have built uniqueness of composition into this formulation (thus taking sides on controversy), and (ii) I have introduced absolutely no restrictions on the *xs*—let them be concrete or abstract or mixture.

Third Move. A mereological simple is an object that has no proper parts. A mereological composite is an object that has proper parts. This is exhaustive. Thus, the Mereological Principle:

(MP) Every object is either a mereological simple or a mereological composite.

Now consider the putative objects countenanced by theses (T1) – (T3):

Haecceity Properties
Exemplification Facts
Singletons

In each case, we can either deny that we are dealing with a genuine object or else confront the question invited by (MP), namely—"Is the object at issue a mereological simple or a mereological composite?" It may well seem that each of the sorts of entities on the list above (if they exist at all) are excellent candidates for being mereological simples. In fact, David Lewis has devoted an entire book, *Parts of Classes*, to the virtues of recognizing singletons as mereological simples (*op. cit.*). We might acknowledge that one of these kinds involves instantiations, another constituents, and yet another members—but neither instantiation nor constituency nor membership is the parthood relation. Significantly, then, each of the theses (T1) – (T3) can reasonably be thought to yield a one-one function from objects to mereological simples.[3]

Fourth Move. Any operation, Φ, that takes us from an object to its haecceity, or to some one of its many exemplification facts, or to its singleton—has three salient features that together determine such a one-one function from objects to mereological simples[4]

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[3] Armstrong occasionally suggests that the constituents of exemplification facts are bound up in "a nonmereological mode of composition" (for example, in his *A World of States of Affairs* (New York: Cambridge, 1997), p. 122), but this proliferation of parthood relations does not seem to be in conflict with what I have said here.

> Totality $\forall x\, \exists y\, (y = \Phi x)$ (that is, you always get something when you subject an object to that operation)
> Uniqueness $\forall x\, \forall y\, (\Phi x = \Phi y \supset x = y)$ (that is, no two objects yield the same thing when subjected to that operation)
> Atomicity $\forall x\, \forall y$ (y is a part of $\Phi x \supset y = \Phi x$) (that is, subjecting an object to that operation always a results in a simple thing)

Only one more piece of staging is required and that is a Cantorian contribution A set always has more subsets than elements If a set has n members, it has 2^n subsets, and whether n is finite or infinite, 2^n is greater than n Naturally, then, given (UMC), the set of all mereological simples is such that for each of its nonempty subsets, s, there is a unique object that is the fusion of the members in s Thus, if there are n mereological simples, there are at least 2^n-1 objects, and similarly, 2^n-1 is greater than n for any finite or infinite n (where $n \neq 1$)

The backdrop is now in place, and we can turn our attention to the main argument

The Main Argument

(1) (UMC)
(2) If (UMC), then there are more objects than mereological simples
(3) Hence, there are more objects than mereological simples [(1), (2)]
(4) If there are more objects than mereological simples, then there are no one-one functions from objects to mereological simples
(5) Hence, there are no one-one functions from objects to mereological simples [(3), (4)]
(6) If there are no one-one functions from objects to mereological simples, then each of the metaphysical theses (T1) – (T3) is false
(7) Hence, each of metaphysical theses (T1) – (T3) is false [(5), (6)]

Lines (3), (5), and (7) are valid inferences Accordingly, the initial targets in this argument are premises (1), (2), (4), and (6) But no one should challenge the Cantorian contribution upon which the defense of (2) rests, and no one should challenge the utterly obvious truth which (4) asserts Consequently, the remaining options for dealing with this argument seem to reduce to denying premise (1) or denying premise (6) or accepting claim (7) If we like, we can take as given the existence of some objects and the powerset-point noted above, and then present our predicament as a series of inconsistent triads

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[4] Again, I borrow this elegant way of putting the issue from Rosen

(IT1) [(UMC), (T1), (T1) yields a one-one function from objects to mereological simples]
(IT2) [(UMC), (T2), (T2) yields a one-one function from objects to mereological simples]
(IT3) [(UMC), (T3), (T3) yields a one-one function from objects to mereological simples]

and so on for each metaphysical thesis from the same family as (T1) – (T3) If you are like me, however, you are at least initially inclined to accept each member of each of these inconsistent triads Unfortunately, something has to give!

Well, what might be said to cushion the blow of accepting (7)? I imagine the lean ontologists with their sparse theory of properties and their lingering suspicion of truthmakers can live without (T1) and (T2), but I am all for a "phat" ontology chock full of properties and facts of the most remarkable kinds But even if we were to give on those points, should we really relinquish (T3)? The relation of singleton to its member is mystery enough, why compound the mysteries by restricting eligibility for singletons? This is not Russell's Paradox Contradiction does not compel restriction Mereological not sacred principles are at work here, and a mereological principle—even (UMC)—is negotiable Embracing the conclusion of the Main Argument is simply a very unattractive option (or so it seems to me) Accordingly, it would appear that either premise (1) is false or premise (6) is false or there is some route of escape from the argument about which I can say only that it has thus far escaped me

Before pressing on, one quick note for those who are worried that in its talk of functions and appeal to Cantor's theorem, the Main Argument illegitimately presupposes that there are only set-many simples, it is worth noting that the Cantorian contribution backing premise (2) may be inessential It would seem a direct contradiction can be derived from conjoining (UMC) with totality, uniqueness, and atomicity[5] Although the pattern of argument presented below can be replicated with any protagonist from a member of the T-family, let us consider an example featuring singletons So, assume (toward *reductio*) our quartet—that is, assume (UMC) together with totality, uniqueness, and atomicity for singletons

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[5] I am very grateful to Uzquiano for raising this objection in correspondence and for helping me to see how to overcome it

The Reductio Argument

(1) x is problematic $=_{\text{df}}$ x is an atom, x is a singleton, and x is not a part of its only member
(2) let A be the fusion of all the problematic items [by atomicity, totality, (UMC)]
(3) A has a singleton, {A} [by (2), totality]
(4) {A} either is a part of A or is not a part of A [obvious]
(5) Suppose {A} is a part of A [*reductio* assumption]
(6) So, {A} is problematic [by (5), atomicity, (2)]
(7) So, {A} is not a part of A [by (6), (1)]
(8) Suppose {A} is not a part of A [*reductio* assumption]
(9) So, {A} is problematic [by (8), atomicity, (1)]
(10) So, {A} is a part of A [by (9), (2)]
(11) So, {A} neither is a part of A nor is not a part of A [by (5)–(7), (8)–(10)]

With this quick proof now in place as a safety net, let us return to our discussion of the Main Argument

The most obvious response to the Main Argument, of course, is simply to restrict composition and to deny premise (1) It is intriguing, however, just how much deep-rooted opposition this recommendation encounters Among many of our most distinguished analytic metaphysicians (UMC) has an honorary status approaching that of a logical truth, it is the sort of thing you just do not mess with Go ahead and explain to the initially perplexed the dangers of restricting composition (for example, the threat of ontological vagueness and other horrors), gently help them to recognize that it is just their own parochial interests and narrow values that generate that unfounded skepticism against the fusion of all the extant copies of the Gutenberg Bible and the ruin at Stonehenge, get them to see that they would be wise to restrict their attention (rather than their principles of composition) when it comes to these unfamiliar but perfectly respectable pieces of the world's furniture, and finally—if you *must* argue further—showcase the theoretical benefits of unrestricted composition in modality, in set theory, in whatever but just remember, come what may Thou shall not restrict composition

Let us try elsewhere Earlier I noted that haecceity properties, exemplification facts, and singletons seem excellent candidates for being mereological simples, these items (if they exist at all) seem to be atomic Maybe that was too hasty Even if instantiation, constituency, and membership are distinct from parthood, perhaps a property like 'Brodyness', a fact like 'Brody's being black', and the class with Brody as its sole member are all mereologically composite

Why in the world would anybody think so? Well, in light of the substantial literature in favor of (UMC), we might think we have better reasons to believe that composition is unrestricted than to believe that any of these items is a mereological simple After all, the present argument has driven us to recognize that we must make an unpleasant choice of just this kind

Unfortunately, resolution does not come that easily[6] Composites will not rescue us unless they also overlap With Rosen let us call any pair of composite objects that do not overlap *relative atoms* Then the same Cantorian reasoning that we saw before can be pressed into service once again to show that if there are n relative atoms, unrestricted summing will yield 2^n-1 distinct objects as their fusions Consequently, any one-one function from objects to relative atoms simply lands us where we were before—with extreme pressure to restrict composition

What of the much-maligned and so-called "null individual" (that elusive counterpart to the null set in set theory) whose most distinctive feature is that it is a part of everything? If universal overlap is desired, perhaps we should seriously consider befriending the null individual Regrettably, however, not just any kind of overlap will do the trick Take the case of singletons Note that (UMC) requires a unique fusion of any singletons But (even in the presence of some overlap between any distinct singletons it may remain the case that) the fusion of the singletons of the *xs* is identical to the fusion of the singletons of the *ys* exactly when the *xs* are themselves identical to the *ys* But Cantorian reasoning then shows that there are more fusions of singletons than singletons But by (T3) any fusion of singletons has a unique singleton That spells trouble

Consider an imperfect comparison Assume that every material object occupies a region of spacetime and that there is no co-location Now let $\Phi x =$ the region of spacetime occupied by x, let the $xs =$ the top halves of all dogs together with the bottom halves of all dogs, and let the $ys =$ the left halves of all dogs together with the right halves of all dogs Significantly, it is not true that [(the fusion of the Φs of the $xs =$ the fusion of the Φs of the ys) iff $\forall z$ (z is one of the xs iff z is one of the ys)] In other words, the distinct pluralities of our comparison case are linked to one and the same entity which is the fusion of each of their respective Φs. Informally, this result exploits the fact that a single region can be a proper part of the fusion of some others without thereby being identical to one of those others (for example, the region occupied by the top half of Brody is a proper part of the fusion of the regions occupied by her right half and her left half). The lesson of the comparison case, though, inspires pessimism. What we require for the right kind of overlap in our central case is for some singleton (x) to be a proper part of the fusion of some singletons (*the* ys) even though x is not one of the ys. (Likewise for similar cases—for example, for some haecceity to be a proper part of the fusion of some haecceities without being among their number, and for some exemplification fact to be a proper part of the fusion of some exemplification facts without being among their number.)

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[6] See Rosen Uzquiano also contains a nice discussion of the remarks on overlap to follow Significantly, Uzquiano has suggested in correspondence that our focus on Totality, Uniqueness, and Atomicity may well be overkill, and that we will have problem enough if a given operation, Φ, merely satisfies Totality, Uniqueness, and Unique Decomposition (that is, the principle that any fusion of Φs has a unique decomposition into Φs) I think he is right In the two paragraphs in the text following the one in which this note appears I explore this suggestion

For would be proponents of (UMC) like me who are also attracted to one or more of (T1) – (T3), this should come as very unwelcome news. We are in need of a kind of overlap that we seem to have no prospects of securing. Otherwise, we must sin. Otherwise, we cannot honor the Lewisian commandment—"Thou shall not restrict composition." As is all too familiar, however, we would have some choice about how we sin. Which restriction on composition is least offensive?

II. RESISTING THE TEMPTATION TO SIN

But they are all offensive! Let us stall a little while longer (even if only to richly illustrate just how futile stalling really is). Focus on singletons. At the end of the preceding section, I noted that things would go well for us if some singleton (x) turns out to be a proper part of the fusion of some singletons (*the* ys) even though x is not one of the ys. With what, then, might we identify the singletons so that the desired mereology no longer seems crazy—or barring that kind of success—so that it no longer seems more crazy than restricting composition?

Imagine God exists and has a *de re* belief about each thing and about each plurality of things. Further let us say that such *de re* beliefs are facts or events (that is, let 'God's believing Brody exists' be among the kinds of exemplification facts at issue in thesis (T2) above). Now, Alice and Hannah are some things—they are some mereological simples. Accordingly, we are in a position to distinguish between the following four facts:

(G1) God's believing Alice exists
(G2) God's believing Hannah exists
(G3) God's believing AliceHannah exists (that is, the mereological fusion of Alice and Hannah)
(G4) God's believing Alice and Hannah exist (that is, the plurality of Alice and Hannah)

Theists among us are free to hypothesize that (G1) is Alice's singleton, (G2) is Hannah's singleton, (G3) is AliceHannah's singleton, and (G4) is the Alice, Hannah doubleton. But will this not just invite another of our inconsistent triads? Will not God's believing of each thing that it exists simply necessitate a one-one function from objects to mereologically-simple, Divine belief states or facts?[7] Perhaps not, for the theists among us are also free to identify the mereological fusion of (G1) and (G2) with (G3), and (at the expense of some genuine weirdness in their account of Divine beliefs) thereby maintain that some Divine belief states or facts have other Divine belief states or facts as proper parts. In other words, on this proposal, God's belief in the existence of a composite just is the mereological sum of God's respective beliefs in the existence of its proper parts. If this were the true metaphysics of singletons, then singletons would turn out to be proper parts of the fusions of other singletons exactly when and in just the ways we need them to in order to block the reasoning threatening (UMC).

On this metaphysics of singletons, (T3) is validated—that is, every object has one. Moreover, we would be in a position to affirm (as David Lewis is famous for remarking) that "there is more mereology in set theory than we usually think,"[8] but it would not be the mereology Lewis thinks is there. On Lewis's view, singletons are mereological simples and all other classes are fusions of singletons. On the present view singletons are composite exactly when their members are and no other classes are fusions of singletons. Of course, we would also be in a position to affirm that "there is more theology in set theory than we usually think," and that is certain to put some people in search of another path. That is all right, though, let them look. It is a boring and obvious truth that what one believes exists should play a role in one's ontology, and the theists should not apologize for exploring the avenues that seem open to them.[9] What, then, are the prospects for this metaphysics of singletons?

One nice feature is its immediate account of the membership relation. To be a member is to be the subject of a Divine existential belief, when the belief is singular, it is to be the element of a singleton, when plural, of a nonsingleton What is more, doubletons and the rest are (like singletons) sometimes simple sometimes composite, the variation fixed by the simple or composite nature of their members But not all is well, for what should we make of the claim—"no Divine belief takes itself as its own object"—apparently crucial to saving the desperate strategy sketched above from a violation of Foundation or an endorsement of the Universal and Russell sets? Well, one thing we can make of it is trouble for our theist Suppose there are some exemplification facts that we identify as the Divine existential beliefs, the DBs Then there is a truth of the form 'The DBs exist' But God, being omniscient, knows every truth So, God believes "The DBs exist " But then this belief is itself among the DBs and in opposition to the requirement that no Divine belief takes itself as its own object I imagine that further restricting omniscience to save (UMC) is unlikely to appeal to the theist

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[7] For an intriguing presentation and defense of two versions of this line of reasoning and of its implications for the possibility of an omniscient being, see Joshua Spencer, "Two Mereological Arguments against the Possibility of an Omniscient Being," *Philo* (forthcoming).

[8] The opening sentence of Lewis, *Parts of Classes*.

[9] Moreover, those theists who find appealing the suggestion that mathematical truths somehow depend on God's nature would have an interesting side issue to explore: foundations of the sort that set theory can provide for mathematics together with the identification of singletons and certain Divine beliefs would secure at least one nontrivial sense of dependence of mathematical truth on God.

Moreover, does not exploiting this consequence of omniscience by insisting that

(T4) Each object is believed by God to exist

presuppose the existence of a full complement of existential propositions? But reflection on such items just draws our attention to yet another member of that troublesome T-family

(T5) Each object is the subject of a singular existential proposition

Indeed, does not focusing on Divine belief in these propositions just add a superfluous layer that serves only to divert our attention from the manifest implausibility of the (analogous) claims concerning overlap that would have to describe the relevant propositions themselves as well as describing God's beliefs in them?

Just what can the proponents of (T5) say? Well, they might point out that the widely held (T5) is either true or it is not If true, then (like it or not) the proponent of (UMC) is *committed* to the relevant and bizarre thesis regarding overlap in order to block the move to a one-one function from objects to mereological simples And if not true (that is, if there are not in fact enough singular existential propositions to go around), we still have to deal with whether proponents of (UMC) must relinquish haecceities, exemplification facts, singletons, and standard characterizations of an omniscient, as well Here, perhaps, theism would not prove to be superfluous after all That is, even if we were to forego the objects of Divine belief—the propositions—we would still have an appropriate range of episodes of Divine awareness

(T6) Each object is the subject of an episode of Divine awareness

De re awareness may substitute for *de re* belief in our rescue of singletons, with

(G1)* God's awareness of Alice
(G2)* God's awareness of Hannah
(G3)* God's awareness of AliceHannah (that is, of the mereological fusion of Alice and Hannah)
(G4)* God's awareness of Alice and Hannah (that is, of the plurality of Alice and Hannah)

taking up the duties of their counterparts above And since (unlike Divine belief) no Divine awareness takes itself as its own object, we may avoid a violation of Foundation and bar the Universal and Russell sets, after all An improvement, then—but not yet a victory, for that really does not make the requisite mereology of Divine episodes of awareness any easier to swallow But perhaps enough has now been said to drive that point home sufficiently

So what is the upshot of our excursion into theistic mereology? Cold comfort to the atheist, not much pull on the agnostic, wrongheaded even from the perspective of the theist But if so, our ill-conceived attempt at stalling has come to an end If we cannot secure the right kind of overlap, we must sin But again, we have some choice about how we sin Which restriction on composition is least offensive?

III CONFINING COMPOSITION

This one?

(LCC) A plurality of objects has a mereological sum exactly when it is logically possible for them to have one

No, for this will not restrict anything Nothing in the discussion above threatens the logical possibility of a universal fusion Moreover, logical possibility does not preclude genuine (that is, metaphysical) impossibility, it merely precludes a specific manner of demonstrating genuine impossibility, namely, by appeal to certain meanings and certain logical rules[10]

Perhaps this one?

(MCC) A plurality of objects has a mereological sum exactly when it is metaphysically possible for them to have one

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[10] For further discussion on this point, see van Inwagen, "Modal Epistemology" *Philosophical Studies*, xcii (1998) 67–84

Well, I think that is true, but so does the proponent of (UMC).[11] The difference between us may consist in whether we think it manages to restrict composition. The family of inconsistent triads discussed in section I above suggests that it does embody a restriction, the overlap discussed in section II that it does not. Whether it states a restriction or not, though, it is not really a candidate answer to the Special Composition Question since it employs the term 'mereological sum'. But official answer or not—in light of the disappointing results of Section II, it certainly appears to be a concession of sorts. What would it take to transform the concession into an official restricted answer to the Special Composition Question? Presumably it would take stating the conditions under which the restriction would be operative—the conditions that would block the relevant metaphysical impossibilities—and doing so without employing any of the members of a certain family of mereological terms. We could attempt it piecemeal, of course, adding pieces by looking to those inconsistent triads whose T-member strikes us as a true metaphysical thesis and whose prospects for associated overlap are as dim as those of the singletons. I suspect, though, that the result would have a somewhat less-than-unified/ad hoc flavor to it that would make an enumeration-of-exceptions strategy appear artificially precise and unsatisfying.

Here is a rather more informative suggestion that I find considerably more appealing, less ad hoc, and a promising area for further investigation.[12]

> (CCC) A plurality of objects has a mereological sum exactly when all of them belong to the same fundamental ontological kind.

What of Categorially Confined Composition? Presumably its plausibility will be determined in part by which kinds are taken to be the fundamental ones. Shall we carve the world into the concrete and the abstract and leave it at that? Or perhaps into substances, properties/relations, and facts? Or maybe into the material and the immaterial? Or into objects, stuff, and spacetime?[13]

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[11] With the possible exception of Lewis and his crossworld fusions, whose parts have a sum even though it is metaphysically impossible for them to have one. (But on Lewis's view this is not as terrible as it sounds. See Hudson, "Brute Facts," *Australasian Journal of Philosophy*, LXXV (1997): 77–82.) Thanks to Stuart Brock for reminding me of this exception.

[12] A sentiment shared to some extent by Mark Heller, Markosian, Jonathan Schaffer, and Dean Zimmerman—who all independently proposed some variant on this restriction in comments on an ancestor of this paper, most frequently by suggesting the (somewhat weaker) denial of cross-category composition.

[13] No further comprehensive list of options to be had here, just the remark that a variant on (CCC) might permit different ontological kinds to obey different com-

I worry that the proposed restriction may not avoid the original problem. Things may go well for a fundamental kind like 'spacetime region', but suppose 'material object' (as opposed to 'material substance') is a fundamental kind, and that exemplification facts are material objects. Then (CCC) will assure us that there are more material objects than there are simple material objects. But (T2) tells us that each material object is the subject of an exemplification fact. On the reasonable hypothesis that the exemplification facts do not exhibit the kind of overlap explored in section II, it follows that there is a one-one function from material objects to simple material objects, and we are back where we started. Or suppose 'abstract object' is a fundamental kind, and that haecceities and singletons are both mereologically simple and abstract. Endorse (T1) or (T3), and we are down again.

So, which well-motivated and principled restriction on composition is least offensive? I just do not know. Here is an interesting parting thought for this section, though. If (UMC) falls, and it really does turn out that there is no universal thing which has everything else as a proper part, then we may well live in a partialverse. Compare: whereas a universe of atomless gunk would contain objects each of whose parts has further proper parts, each inhabitant of a partialverse would be an object such that each thing which has it as a part is, in turn, a proper part of some further thing, topless rather than bottomless.[14] On the other hand, if (CCC) is true and there are (for example) four fundamental ontological kinds, then we may well live in a quadriverse—a world comprised of four, nonoverlapping, topmost entities each claiming all and only the items falling under its kind among its parts.

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positional and decompositional principles. Moreover (as Markosian has suggested to me in conversation) just which compositional and decompositional principles a given candidate conforms to might even turn out to be the primary criterion of membership for its fundamental kind. See also Markosian, "The Right Stuff" (unpublished).

[14] To be honest, both hypotheses feel repugnant to me, but now that I take (UMC) to be in genuine jeopardy I think the likelihood of our living in a partialverse is higher than the likelihood that we live among atomless gunk. Lewis introduced the term 'atomless gunk' in his *Parts of Classes*. Elsewhere, I have argued against the possibility of material atomless gunk (chapter 3 of my *A Materialist Metaphysics of the Human Person*), but for further and more sympathetic discussion on gunk, see Forrest, "Grit or Gunk: Implications of the Banach-Tarski Paradox," *The Monist*, LXXXVII (2004): 351–70; John Hawthorne and Brian Weatherson, "Chopping Up Gunk," *The Monist*, LXXXVII (2004): 339–50; Allen Hazen, "Hypergunk," *The Monist*, LXXXVII (2004): 322–38; Daniel Nolan, "Classes, Worlds, and Hypergunk," *The Monist*, LXXXVII (2004): 303–21; Zimmerman, "Could Extended Objects Be Made out of Simple Parts? An Argument for 'Atomless Gunk'," *Philosophy and Phenomenological Research*, LVI (1996): 1–29.

IV A NEW DIRECTION AND AN UNLIKELY HERO

Even in the absence of settling on a well-motivated and principled manner of restricting (UMC), however, we might turn our attention to the problem of defending a principle that does not succumb to similar paradoxes, but that nevertheless yields many of those unfamiliar objects whose credentials were once furnished by (UMC) With such an aim in mind, perhaps we should, as John Bigelow has argued, look to set theory for motivation and a precedent [15] Bigelow suggests that we forfeit (UMC) in favor of a principle he christens "Mereological Separation " Bigelow adopts as his model for such a restriction the replacement of the Unrestricted Comprehension Axiom with the Axiom of Separation in ZF set theory Consider the Unrestricted Comprehension Axiom

> (UCA) For any predicate, there is a set containing all and only the things to which that predicate applies

Now consider the Axiom of Separation

> (AS) For any given predicate and any given set, there is a set which consists of all and only the things which are both members of the given set, and things to which the given predicate applies

Russell's paradox has convinced us of the advantages of (AS) over (UCA) Perhaps mereology can take a lesson here Accordingly, consider Bigelow's formulation of Unrestricted Mereological Composition

> (UMC*) Whenever there are some things, then there is a single thing of which all these things are parts

Now consider Bigelow's formulation of the principle of Mereological Separation

> (MS) Whenever there are some given things, and there is also a further, designated thing, then there is a unique smallest thing which is part of the designated thing and which also comprises as parts all the given things which are parts of the designated thing

Now this is more of a carving principle than a principle of composition, once you have an object (MS) will assist you in identifying others, but unless you have an object to work with it is idle Still, if true, it would yield an astonishing range of objects so unfamiliar and counter-intuitive that (UMC) might have been thought their only defense But is it true? Let all the simples which compose the gargoyle on my desk (whose name is 'Confusion') be our candidate for "some given things" and let our candidate for the "further designated thing" be my dog, Leibniz Now, (MS) tells us that there exists "a unique smallest thing" (hereby named 'Littlest') that satisfies a complex condition first, Littlest must be among the parts of Leibniz, and second, Littlest must have as a part each simple which is both a part of Confusion and a part of Leibniz Unfortunately, though, since Confusion and Leibniz do not seem to overlap (that is, it would seem that there is no thing which is a part of them both), this second condition would appear to be satisfied trivially by *any* of Leibniz's parts which we might hope to identify with Littlest But then this would also guarantee that there is nothing that answers to the phrase 'a unique smallest thing' that satisfies the two descriptions, since every single one of Leibniz's simple parts would be equally well-suited for the job Counterexample

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[15] Bigelow, "God and the New Math " The next three paragraphs (with modifications) are borrowed from chapter 3 of my *A Materialist Metaphysics of the Human Person* The formulations of the next four principles that appear in the text—that is, of (UCA), (AS), (UMC*), and (MS)—are Bigelow's I would like to acknowledge I have come to adopt a somewhat more optimistic view of Bigelow's general strategy than I had in 2001

Unless appearances are deceiving Even if it could not rescue (UMC) by providing the right kind of overlap for haecceities, exemplification facts, or singletons, perhaps the null individual can come to our aid in the present predicament by providing a point of overlap for Confusion and Leibniz, for me and you, and for the items in any plurality we care to name Curiously, the null individual has not really received a lot of positive press, perhaps stemming in part from its rather dyslogistic name [16] Occasionally it is mentioned in passing as an embarrassment, as a disanalogy to be explained away, as something which would be even more a mystery than the null set, as something for which no serviceable function can be discerned that might entitle it to existence Maybe, though, in helping us secure a compositional principle that has some chance of being well motivated, we have just found it a worthwhile job to do

A transparently tenuous transition Of course, the null individual would be an analogue of the null set in a rather salient way Whereas the null set is a subset of every set—a guaranteed intersection, the null individual would be a part of every thing—a locus of universal overlap In the remainder of this paper, I would like to renew a critical investigation into the null individual—partly on the grounds that doing so might save Bigelow's (MS) from counterexample, thereby leaving on the table an attractive candidate for a mereological principle that we liberal composition theorists can learn to live with after losing (UMC) and partly on the grounds that it is philosophically interesting in its own right

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[16] Exceptions include Mario Bunge, "On Null Individuals," this JOURNAL, LXIII, 24 (December 22, 1966) 776–78, Harry Bunt, *Mass Terms and Model-Theoretic Semantics* (New York Cambridge, 1985), Lewis, *Parts of Classes*; R M Martin, "Of Time and the Null Individual," this JOURNAL, LXII, 24 (December 16, 1965) 723–36, J W Swanson, "The Singular Case of the Null Individual in the Empty Domain," this JOURNAL, LXIII, 24 (December 22, 1966) 772–76

V THE NULL INDIVIDUAL

Let us introduce and discuss our character I shall do so throughout this section using 'is' rather than 'would be, if it exists', not because I think its existence has been demonstrated, but only for convenience of expression The null individual is one of a kind That is, just as the null set is the only set with no members, the null individual is the only individual with no proper parts Such uniqueness follows from a thesis that is constitutive of the parthood relation, namely the antisymmetric thesis—[(x is a part of y and y is a part of x) only if x=y] Suppose (toward *reductio*) that there were two null individuals But then by their most salient feature they would be parts of one another But then by the antisymmetric thesis they would not be two So, there is but one, after all

Does this distinctive entity belong among the abstract or the concrete things? Well, it is a part of the number 2,011,811,051,145 and of the property 'being white' which seems to speak in favor of classifying it with the abstracta, but it is also a part of the nearest chunk of marble and of the first baptismal event which seems to speak in favor of classifying it with the concreta It resembles the abstract objects in lacking causal powers, but is like the concrete ones in having neither instances nor members If forced—I would say (with no great enthusiasm and even less argument) "concrete " But fortunately, I strongly suspect that the abstract/concrete distinction is not a fundamental ontological divide to begin with, and lacking comfortable classification here is no great embarrassment

Should we regard it as a necessarily or contingently existing entity? Pressure to countenance the null individual at all seems equally present in every world, and so the alternatives, I suppose, are to think that either it is a necessary being or else that necessarily, there is a null individual (but not require the same item to play that role across worlds) The latter option, though, would make for an odd plurality of worlds (otherwise populated only by necessarily existing things) and differing merely in which contingent entity played the role of the null individual Significantly, if the same item is the null individual in every world, then it is has the distinctive feature of being an essential part of each existing thing, thus weighing in on at least one metaphysical controversy. Moreover, if both necessary and concrete, we have a quick answer to a long-standing metaphysical question—"Why is there something concrete rather than nothing concrete at all?"—the answer being—"because it is not possible that there be nothing concrete."

Others have tried to put the null individual to work in various ways. Its most famous employment is simply to permit the calculus of individuals to be developed as a full Boolean algebra and to secure all the elegance of structure that then comes for free. But it has also been invited (i) to serve as the referent for definite descriptions which otherwise seem to fail to refer on grounds of uniqueness, (ii) to be the sole inhabitant of so-called "empty domains" of quantification, (iii) to define an existence operator and a predicate for existence, (iv) to play a role in resolving various issues in the philosophy of time, (v) to mereologize set theory, and (vi) now—in the section above—to rescue from counterexample a principle designed to partially substitute for the forfeited (UMC).[17]

What I find most intriguing about the null individual, however, is its surprising role in rethinking outstanding questions regarding the correct extensions of the basic theory of mereology (that is, of Ground Mereology) as well as its potential contributions to a number of intensely debated topics in mereological metaphysics. And if (in the end) it cannot credibly be credited with resolving these questions or settling these controversies—at the very least, the null individual will play a part in reframing the way we pursue these investigations.

On Mereological Theory.[18] Ground Mereology strengthened by a Strong Supplementation Principle (a principle which prohibits distinct objects sharing exactly the same proper parts) is known as Extensional Mereology.

(SS) Necessarily, for any *x* and *y*, if *x* does not have *y* as a part, then there exists a *z* such that *z* is a part of *y* and *z* does not overlap *x*.

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[17] See Martin for discussion of items (i)–(iv) and Bunt for (v). For a critique of (ii) see Swanson. For a critique of (v) see Lewis, *Parts of Classes*. My own view is that Martin sees the null individual as qualified for the tasks in (i)–(iv) precisely because he (like Bunge) does not really believe it exists, and thus does not hold it to very exacting standards. Martin's opening two sentences: "Is there such a thing as the null individual? Well, as an actual or concrete entity, certainly not." The null individual never really manages to recover from this stumbling start, even though Martin suggests that it stands in all manner of relations to other things.

[18] For a very accessible discussion, see Achille Varzi, "Mereology," *The Stanford Encyclopedia of Philosophy (Fall 2004 Edition)*, Edward N. Zalta, ed.

A somewhat less ambitious addition is provided by a Weak Supplementation Principle yielding a theory stronger than Ground Mereology but less powerful than Extensional Mereology

(WS) Necessarily, for any *x* and *y*, if *x* has *y* as a proper part, then there exists a *z* such that *z* is a part of *x* and *z* does not overlap *y*

Should we supplement Ground Mereology in this manner? Our current hypothesis yields a negative answer Many objects may turn out to have only one proper part, namely those we mistook for simples before recognizing the ubiquity of the null individual If so, any "remainder-principle" formulated in the manner of (WS) is false Moreover since (WS) is entailed by (SS), the falsity infects Seen from another angle, since the consequents of (SS) and (WS) both deny some instance of overlap, the null individual with its willingness to indiscriminately attach itself to anything and everything will put both principles in jeopardy Supplementation, if there is to be any, must come some other way

Just to be clear, this threat to the letter of Extensional Mereology is rather different from the threats to its spirit posed by the very rich and intriguing literature on the problems of material constitution [19] And presumably, there are "fixes" that will license familiar inferences regarding the identity of composites that draw merely upon premises identifying their proper parts—it is just that these fixes will either require a caveat regarding the null individual or an unfamiliar amendment to the standard definition of 'proper part'

On Mereological Metaphysics A few rather prominent metaphysical extravaganzas have relied in a crucial way on the denial of overlap for certain individuals Leibniz's *Monadology* is a case in point Among contemporary examples perhaps the most famous is Lewis's modal realism, extreme in countenancing uncountably many spatiotemporally and causally disconnected spacetimes (or spacetime substitutes) which serve both as possible worlds and as a mechanism for wide-ranging reductive metaphysics [20] The null individual banishes such worlds All things overlap—even LewisWorlds, if there are any For the same reason, Lewis's attempt to mereologize set theory would need retooling, for insofar as all singletons overlap, none is a mereological atom as claimed by Lewis [21] Nothing fatal here, I suspect Perhaps LewisWorlds can stand the strain of some overlap, and perhaps nothing of real significance is lost if each of the singletons has to bear one (and the same) proper part However, the precise formulations of these new systems and whether they introduce any inconsistency into whatever metaphysics is on display remains to be seen [22]

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[19] See Sider for an overview

[20] Lewis, *On the Plurality of Worlds*

[21] Lewis, *Parts of Classes*

Another area of current intense attention in the metaphysics literature concerns an investigation into the nature of mereological simples Ned Markosian recently raised the Simple Question, roughly asking us for a true and illuminating way to fill in the blank in this schema—'Necessarily, *x* is a material simple iff __________' [23] Let us relax the restriction to material objects, however, and ask for a true and illuminating way to fill in the blank in this schema—'Necessarily, *x* is a simple iff __________' Here is the simple answer "*x* is identical to the null individual " Even though the proper analysis of 'mereological simple' has been a topic of dispute, all parties agree that (by definition) a mereological simple is an object without proper parts Thus, owing to its unfailing ability to show up on everyone's list of parts, the null individual is simply the only qualified candidate for the job We could, of course, ask after the true and illuminating, necessary and sufficient conditions for being a near simple—that is, for having exactly one proper part, or for being a robust composite—that is, for having multiple proper parts, but those are different inquiries

Similarly, consider the fascinating debate on the existence (or possible existence) of atomless gunk—that is, objects such that each of their proper parts has proper parts The null individual puts a decisive end to that debate—at least when pursued under that description No object is such that each of its proper parts has proper parts, for any candidate either is identical to the null individual or else claims it as a proper part, and the null individual simply lacks the requisite parts to move the series to a lower level We are still free to inquire, however, whether there can be objects each of whose non-null parts has multiple proper parts

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[22] A quick example Should the null individual turn out to be located, we would have to relinquish the plausible principle that if *x* is some distance from *y* and *y* is some other distance from *z*, then *x* is some distance from *z*—otherwise, LewisWorlds would be spatiotemporally related, after all

[23] Markosian, "Simples," *Australasian Journal of Philosophy*, LXXVI (1998) 213–26 For recent discussion on simples and the Simple Question, see Katherine Hawley, "Borderline Simple or Extremely Simple," *The Monist*, LXXXVII (2004) 385–404, Hudson, *A Materialist Metaphysics of the Human Person*, Markosian, "Simples, Stuff, and Simple People," *The Monist*, LXXXVII (2004) 405–28, Kris McDaniel, "Brutal Simples," in Zimmerman, ed , *Oxford Studies in Metaphysics, Volume III* (New York Oxford, forthcoming), Peter Simons, "Extended Simples A Third Way Between Atoms and Gunk," *The Monist*, LXXVII (2004) 371–84

Finally (and this one has the most metaphysical bite) note the debates on persistence and on the varieties of location.[24] One way into the latter (and more comprehensive) debate is to think on the questions—"How are objects related to the regions that host them?" "Is the location relation one-many?" and "If a single thing is located at more than one region does it accomplish this trick merely by being partly located at each of the relevant regions or by being wholly or entirely located at each of them?" Assuming substantivalism, the null individual is a part not only of every located object, but also of the locations themselves. Whereas this feature alone may not suffice for its being located, a persisting null individual presumably would bear some occupation relations, and would do so without spatial or temporal parts, thereby lending the best sort of support to one side of the debates in question—by providing an actual, eternal, and ubiquitous example of endurance and entension (over perdurance and pertension).

VI. DIVINE SIMPLICITY

Time to end with a final few paragraphs of wild speculation. Suppose we did come to believe in the null individual. Desiring to eliminate redundant entries from our ontological lists, we might well ask which thing in our existing ontology is best suited to play the role of the null individual. Well, chances are we do not share an ontology. I will start with my own favorite and work outwards from there.

Here are my clues. The null individual is likely to be a (i) necessarily existing, (ii) concrete, (iii) one of a kind entity; it is (iv) the one and only simple, being a part of everything else. In fact, in virtue of being a part of every point in spacetime, it has a straightforward (albeit nonstandard) claim to be (v) eternal and (vi) omnipresent. One candidate for identification, then, seems to have an edge on the others. The Divine being whose existential beliefs could not rescue (UMC) in section II above may yet have a chance to enter our story before it is over. A theist—or at least one inclined to acknowledge the null individual—should see an affinity here in almost all respects, save the dyslogistic name. The combination of (i)–(iii) with (v)–(vi) above transparently invite such identification. Moreover, given the classical doctrine of God's simplicity, the unique feature noted in (iv) may force (rather than invite) identification.

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[24] See Roberto Casati and Varzi, *Parts and Places: The Structures of Spatial Representation* (Cambridge: MIT, 1999), Hudson, *The Metaphysics of Hyperspace* (New York: Oxford, 2006), Josh Parsons, "Theories of Location," in Zimmerman, ed., *Oxford Studies in Metaphysics, Volume III*.

I know full well, though, that most theists and nontheists alike will be thoroughly unmoved by the charming similarities just noted. Nonetheless, many of these theists have no special reason to retreat from the identification. It is not as if there is something undignified in the whole affair, and there are no restrictions on the null individual that make it obviously unsuited to be the subject of a number of other classical Divine attributes. The comparison is suggestive enough to strike me as initially appealing; it would certainly be interesting to learn why they are two rather than one if both exist.[25]

But the nontheists would have to look harder to find a candidate to identify with the null individual—especially those of them that favor a sparse, naturalistic ontology. Where might they turn? Lewis denies the existence of the null individual, but says if it did exist, we could identify it with the null set. But that is not terribly helpful for, as Lewis has also noted, absolutely any individual has the main credentials for the latter job, namely, memberlessness. Moreover, Lewis's own candidate for the null set, the fusion of all individuals, is clearly unprepared to play a double role. Significantly, appointing that rather unique fusion to the post of the null set seems to avoid arbitrariness of a sort. But what ordinary entity could be assigned the part of the null individual both with some plausible claim to possess features (i)–(vi) above and without intolerable arbitrariness? It almost makes one wonder whether recognizing the null individual could lend some support to the theistic hypothesis, after all.

But that would surely be going too far. We have barely initiated a discussion into the character and the significance of the null individual. And that on the flimsiest of grounds—hoping that it might rescue one principle from one putative counterexample, a principle we turned to in despair of salvaging (UMC). To even tentatively suggest a backdoor argument for theism on the grounds that there is no other nonarbitrary candidate to cast in the role of the null individual is certainly not on the cards.

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[25] To be sure there have been some other theological speculations in the neighborhood, and Nolan reminds me that he has been caught on record encouraging our theists to nominate the devil for the post of the null individual in Graham Oppy, "Pantheism, Quantification, and Mereology," *The Monist*, LXXX (1997): 320–36. Nolan, however, doubts either nominee will be around to win the office.

HYLOMORPHISM

It is, after all, the familiar that is so strange. Take complexity, understood as the condition of having parts, among the most ubiquitous of phenomena. Suddenly, one can be flummoxed by the following very ordinary fact: When certain items come to stand in certain relations, such as being glued together, being coupled with, or being bonded to each other, there then comes to be some *further* item which has those original items as parts. That is presumably how we have such complex items as model airplanes, trains, and molecules. Well, just why are those relations and their ilk, "item-generators," while other relations, such as being six feet from, seem impotent in the production of new items? Whence this invidious ontological distinction? The science of matter does not even consider the invidious distinction as an object of explanation, it simply takes it for granted, and instead explores the forces that hold apparently complex items together. So what does explain the invidious ontological distinction?[1] Could it just be a projection of our idiosyncratic way of experiencing and conceptualizing reality, so that things considered in themselves are not complex, but are so only relative to a scheme of clumping or bundling?

Somehow, I doubt it.

I. PRINCIPLES OF UNITY

Of any item in any category, be it a state, event, activity, material object, artifact, organism, person, quantity of stuff, property, fact, proposition, kind, group, set, or mereological sum, we may inquire whether it is simple or complex, in the sense of having parts. Of any item that has parts we may inquire as to what principle unifies those parts into the whole that is the complex item. The principle had better not be *merely* another part, for the question would remain: Consider that part along with the other parts, what relation is such that its holding of *all* these parts gives us the whole? And that would be the principle we really seek.

So glue may hold together parts of a model airplane, but glue is another part, and it counts as a part along with the wings, the tail, and the fuselage because of a pattern of bonding holding among it and the other parts. This pattern of bonding is not another part,

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[1] A question explored in detail by Peter van Inwagen in his *Material Beings* (Ithaca: Cornell, 1991).

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but rather a way of realizing a principle of unity, a relation that must hold among the parts if they are to be parts of the model airplane. Roughly, they are to *hang together in the modeled shape of an airplane in such a way as to resist separation in the face of the range of forces to which we usually subject such models.* (Here, as below, I italicize the relational predicate that expresses the principle of unity.)

Consider a particular train, that is, an engine and some carriages coupled together, with the engine coupled into a position from which it can pull or drive the train. What it is for a particular train to be is for *enough of* those carriages *and* the engine *to be so coupled.* This complex quantified relation that holds of the engine and the carriages is the principle of unity of the train. There is no need to think of that relation as in any way part of the train. Yet it has to be mentioned in specifying what it is for that train to be. (Notice that it allows the train to have a variable constitution over time.)

We may make a distinction between a complex item's parts, its principle of unity, and its origin (or more generally its place in a pattern of generative operations.) All three factors may enter into the account of what it is for a specific item to be, the account of the essence of the item. For now, we shall prescind from origins, and concentrate on parts and principles.

A principle of unity for a given item is a relation holding of some other items, such that (origins aside) what it is for the given item to be is for the relation to hold among those items. Each genuine kind of complex item will have associated with it a characteristic principle of unity, for arguably, it is sameness in principle of unity and kinds of parts that in turn qualifies the members of a given kind to be included in the complex whole that is the kind.

Consider HCl, a kind of molecule. The principle of unity for individual hydrogen chloride (HCl) molecules is the relation of *bipolar bonding.* So consider a particular HCl molecule, whose genuine parts involve a hydrogen ion (H+) and a chlorine ion (Cl-). The principle of unity holds of the ions, and its holding is the essential condition for existence of the molecule. It is simply an essentialist elaboration of a proposition of chemistry that what it is for a given hydrogen chloride molecule to be is for there to be a hydrogen ion and a chlorine ion together in a bipolar bond. Using our terminology, it follows that bipolar bonding is a principle of unity for hydrogen chloride molecules.

We can go further. We can ask of the complex whole that is the *kind* HCl molecule, what is it that unifies the members of the kind, that is, certain individual molecules, into this whole? The answer would specify the principle of unity of the kind HCl molecule, that is, the relation that holds among the members of the kind, such that its holding makes for the existence of the kind. Well, what it is for the molecular kind HCl to be seems just to be this: there are some individual molecules alike in sharing certain kinds of parts, namely hydrogen ions and chlorine ions, and they are alike in sharing a principle of unity, namely that their hydrogen ion be bound to their chlorine ion. The individual molecules are the members of the kind, the parts of the kind in the extended sense of part intended here. The principle of unity of the kind HCl molecule is just that such individual molecules *share certain kinds of parts, namely hydrogen ions and chlorine ions, and share a certain principle of unity, namely bipolar bonding.*

It is typical of kinds that their examples are alike in parts and principles, so that a discovery of differences in parts or principles "under the skin" of the examples of a given kind prompts the division of the kind into two subkinds. That is how it was with the oft-cited case of Jade, a kind of semi-precious stone. We now distinguish the subkinds Jadite and Nephrite on the strength of their different atomic parts and different molecular structure.

Contrast groups; imagine we found that certain members of the local fire brigade were angels who had assumed a human form. Even so, the deep intrinsic difference between humans and angels would not in itself show that the local fire brigade consisted of two *groups*, the human firefighters and the angelic firefighters. Suppose the angels had no distinctive knowledge of or distinctive association with each other. Suppose they were always mixed in with their human fellows in any firefight. Then, arguably, there would no group of the angelic firefighters. However, it still would be true to say that the brigade had in it two very different *kinds* of firefighters. In the main, groups are more tolerant of intrinsic differences among their members in respect of parts and principles than are the corresponding kinds. This is because the unity of a group depends on some degree of association among the members of the group, not simply on the intrinsic similarity of the members. Thus, the chlorine atoms do not form a group (unless there is something very spooky going on) even though they do form a quite natural kind.

II. PARTHOOD QUITE GENERALLY CONSIDERED

Despite the usefulness of the examples of the model airplane, the train, and the individual HCl molecule, it does not seem to be crucial to the notion of a part that the parts of an item are in any way joined or coupled or bonded to make up the item. Abstract items can have parts or components. So sets might be taken to have their members as parts, without any requirement of bonding or attachment being relevant Conjunctive properties have their conjuncts as parts, but nothing besides conjunction is required for the parts to make up the relevant whole And the debate over whether propositions contain individuals and properties as parts, rather than senses or modes of presentation of individuals and properties, is not menaced by the odd supposition that some analogue of material bonding holds among the components of the proposition In each of these cases there are indeed different principles of unity in play, but it does not follow that there are different notions of part in play There will be a semantic question as to whether the notion of part in play is entirely univocal across all subject matters, or represents a "focal meaning" that is further elaborated within a subject matter, or even from context to context[2] But this is a question best addressed at the end of an investigation that tries to get as far as possible on the assumption of univocity

That methodological suggestion accords with the idea that, at first glance, the relation between an item and its components or parts is a topic-neutral relation of vast generality, applying wherever the notion of complexity gets a foothold It would then be a great mistake to prematurely restrict the scope of one's account of parthood to a few categories such as material objects and arbitrary aggregates For one then runs the risk of misplaced generality, of mistaking idiosyncratic features of a specific category or kind of complex item for general principles governing the relation of parthood itself So it is with the contemporary fascination with mereological sums, as we shall later see

In the same catholic spirit, at this stage of the investigation we should keep at bay those sophisticated considerations of fundamental ontology that might severely prune, or even totally revamp, our ordinary categorical scheme of types of complex objects For there might be something about the notion of complexity that we can most effectively learn by considering a category of ostensible items which could be shown upon reflection not *really* to exist, in the sense of figuring in an acceptable fundamental ontology as either a basic or derived entity So Compositional Nihilists, those who find that there are good reasons in fundamental ontology to deny the reality of complexes, need to check their argumentative guns at the door, at least for now The same applies to those who are persuaded that the only complexes are living things

We should try to make the initial philosophy harder by being friendly to as many kinds of complex items as we can conceive There may be something to be learnt from the contemplation of the nonexistent

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[2] For an extensive examination of this semantic question, see Friederike Moltmann, *Parts and Wholes in Semantics* (New York Oxford, 1995)

III GENUINE PARTS VERSUS “FIAT” PARTS

Returning to the main line, a principle of unity is required to hold among the “genuine” parts or constituents of an item, not among the “merely fiat” parts disclosed by arbitrary principles of division of the item The contrast can be brought out by an example or two

Most arbitrary temporal slices or segments of a complex activity are not the parts united by the principle of unity for that activity Consider last night’s dinner party We may allow that there is such a thing as last night’s dinner party between 9 00 and 9 01 p m , but there need be no relation between that temporal slice of the dinner party and the minute long slices before and after it, such that the relation is properly cited in a unity condition for dinner parties in general, or for this dinner party in particular There may have been an embarrassing hiatus between 8 59 and 9 01, during which nothing really happened at the dinner party Suppose the guests and the hosts “froze” at that point Even so, that period does get included in the dinner party just because it is enveloped by subactivities characteristic of dinner parties They froze *during* the dinner party Those moments were the most embarrassing *part* of the dinner party Yet the relation between the two slices that occupy the successive minutes of the freeze need exhibit nothing of those features properly cited in the unity condition for the dinner party

While arbitrary temporal slices or segments need not correspond to any genuine or natural parts of an activity, it is still the case that what it is to be the activity is to be a sequence of certain temporally extended events united in a certain way So a dinner party may really consist of the following sequence of independent, temporally extended event parts

> the greeting of the guests,
> the downing of drinks,
> the pre-dinner chatting,
> the serving and consuming of the soup,
> the serving and consuming of the main course,
> the serving and consuming of the desert,
> the host’s disconcerting party piece,
> *and then,*
> the hurried farewells

These temporally extended event-parts might constitute a dinner party that happens to last for three hours and seventeen minutes But they constitute that dinner party in a way in which the dinner party is *not* constituted out of the first seventeen-minute temporal slice of the party and the last three-hour temporal slice of the party

The first series of temporally extended events is a series of parts united by a principle of unity typical for dinner parties like this That will be something like *occupying a position in a sequence of events each effected either by the hosts or by the guests for the intended outcome of their mutual feeding, entertainment, and relief* They are the parts and that is the principle that would have to be mentioned in an adequate account of what it is for the dinner party to be

By contrast, the party's last three-hour slice need not be one in a sequence of events effected either by the hosts or the guests for the intended outcome of their mutual feeding and entertainment It would then be a "fiat part," namely a part disclosed by a mere principle of division

For a second example, consider a sentence token, such as the one displayed next

Aristotle liked dogs

There are various principles of division of this sentence token, for example the one that divides it into letters and gaps, and the one that divides it into letter and gap tops, and letter and gap bottoms But to see the token as a sentence token you have to see it as having a form which makes for truth or falsity, and to see it that way you have to take it as having a privileged semantic structure, which in this case we may simplify as a subject/predicate structure involving the subpart that is the token of the name 'Aristotle' and the subpart that is the token of the predicate 'liked dogs' These are the parts which are related by the principle of unity of the sentence token, namely, the semantic relation of *predication of* the predicate token *of the reference of* the name token It is the holding of this semantic principle of unity among those subsentential tokens which enables the sentence token to be true or false, depending on how things stood with Aristotle This principle of unity does not hold among the letters and the gaps, or among the letter and gap tops and the letter and gap bottoms

This is the sense in which the semantics of a sentence token enters into what it is to be the sentence token, at least if the sentence token is understood as having a truth value But the semantics of a sentence token (in this case the simple semantics of reference and predication) is not an extra part of that sentence token It is something that serves to unify the semantically privileged parts into the whole that is the sentence token The genuine parts of a sentence token, as opposed to its merely fiat parts disclosed by various principles of division, are those united by its semantic principle of unity

The analysis of the distinction between principles of unity and principles of division is a matter of some importance and delicacy

Certainly the analysis is not merely formal Whereas a principle of unity can be thought of as associated with a function from given items to another item that those items make up, a principle of division is associated with a function from a given item to items that make up the given item If that were all there was to the matter then we could take the converse of any function that was characteristic of a principle of division and have a function characteristic of a principle of unity But there is, in general, no guarantee that the converse of a function associated with a principle of division for an item will be a natural or nonarbitrary function characteristic of a principle of unity for that item

IV HYLOMORPHISM

A statement of the genuine parts and principle of unity of an item (at a given level of composition) takes the following canonical form

> *What it is for* (the item is specified here) *to be is for* (some parts are specified here) *to have the property or stand in the relation* (the principle of unity is specified here)

As in *What it is for* this hydrochloric acid molecule *to be is for* this positive hydrogen ion and this negative chlorine ion *to* be bonded together

Or in *What it is for* this particular train *to be is for* the engine and enough of those carriages *to* be coupled together, with the engine coupled into a position from which it can pull or drive the carriages (Allowing enough of the carriages, and not requiring all of them, is to allow that the particular train in question can have a varying constitution over time, and across possible worlds)

Or in *What it is for* the singleton of Plato *to be is for* Plato to exist (Here we allow the limiting case where one item's having a property exhausts the essence of another item Thanks to its having the property, the one item is "unified" into another unit Compare my left hand and my left fist)

The idea that each complex item will have some such canonical statement true of it might be fairly called "Hylomorphism " For it is the idea that each complex item admits of a real definition, or statement of its essence, in terms of its matter, understood as parts or components, and its form, understood as a principle of unity When an item's parts are themselves complex, they in their turn will have their own principles of unity (forms) and genuine parts (matter), and so on and so forth, either *ad infinitum,* or terminating in indefinables or "simples " This is the familiar layering of hylomorphic structure, beginning with the immediate parts of a whole, and continuing through the more and more remote parts of that whole

The point of this essay is to explore the prospects of Hylomorphism, understood as this general claim about the shape of the real definitions of complex items

Obviously, this somewhat stipulative invocation of "Hylomorphism" at most picks up a strand or two from the long and daedal tradition stretching (at least) from Aristotle to Francisco Suarez So perhaps it will be of some help to indicate which associated commitments of the tradition are being accepted and which rejected, and which are being passed over in silence

One disputed question in the tradition is whether a whole construed hylomorphically is a *composite* of matter and form, with the form itself understood as another part, along with the more familiar "material" parts of the composite The form cannot be a *mere* part alongside the other parts, it must also play a unifying role Could it play that unifying role, and be a part as well? My fellow contemporary Hylomorphists, Kit Fine and Kathrin Koslicki, take it to be so [3] As will emerge below, the present account denies this, the form is a principle which must be invoked in the real definition of the whole, but it is not a further part

The next disputed question concerns the targets of real definition Are these just kinds of individuals, or do they include the individuals themselves? And if the latter are among the targets of real definition, how is it that members of the very same kind can have different essences or real definitions? Are there essential differences even among exact duplicates? I suppose that there are, and that the most plausible place to locate such differences is not in different principles, for then the duplicates could not be said to be of the same most determinate kind, but in different origins and different original parts

On such a view, we may still allow that individuals of a given kind share an essence type, in the sense of having the same type of parts and the same principle of unity

This last remark bears on perhaps the most controversial issue in the Hylomorphic tradition, namely whether the forms or principles of unity are to be thought of as "trope-like," as individualized characteristics or relations, or instead as universals in the sense of items potentially in common to many distinct individuals Yet once origins and original parts are invoked as the essential differences among individual examples of any kind of complex item, it will no longer be necessary to postulate individualized forms as the source of the individuation of distinct individuals of a given kind.

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[3] See Fine, "Things and Their Parts," in Peter French and Howard Wettstein, eds , *New Directions in Philosophy Midwest Studies in Philosophy, Volume XXIII* (Malden, MA Blackwell, 1999), pp 61–74, and Koslicki, *The Structure of Objects* (forthcoming) Whereas Koslicki's postulation of formal parts is to some degree motivated by a desire to preserve the principle of uniqueness of composition, this does not appear to be motivating Fine's view For Hylomorphism without forms as parts, see my "Constitution Is Not Identity," *Mind*, ci (1991) 89–105

V. REAL DEFINITION AND ESSENCE

Since Hylomorphism is here being presented as a thesis about the shape of certain real definitions, it may be useful to add a word about the objectivity of real definition, even in the case of mind-dependent items. Everything has an essence, and everything that is complex will have a real definition. Whether or not we can find and formulate the real definition is another matter. Think of the mixed history of success and failure, over the last hundred years, in the analysis of concepts, an enterprise properly understood not as seeking nominal definitions, but as the search for the real definitions of complex concepts. The mixed history suggests that the structure of a concept sets an objective standard of success for the analysis of the concept. The structure is arguably an essential feature of the concept, and this remains so even on the view that concepts are artifacts of our mental activity. Compare the sentence token displayed above; it is clearly a human artifact, but its parts and principle of unity are essential to it, and thereby set an objective standard for its proper parsing. (I do not deny that there are other things, with other parts and principles, in the same place as that sentence token; more on that below.)

Some will find the notion of real definition quaint and unworkable. Perhaps the best reason for such an attitude is skepticism about essence, since to give the real definition of an item is to anatomize its essence. If items lack essences, or only have essences relative to the concepts we deploy in characterizing those items, then they do not admit of a real definition. At best, we only can explore the consequences of our ways of conceiving of items.

Still, the enemies of essence should allow that our ways of conceiving of items may well be essentialist. Moreover, there may be a strong hylomorphic element in our ways of conceiving of items, manifest in our ways of tracing items through time, and in our ways of distinguishing between events in which an item of a given kind increases in size and events in that item simply has something else accrete to it.

There is an extensive body of empirical evidence, much of it assembled in Susan A. Gelman's book *The Essential Child*, to the effect that our earliest conceptual framework is quasi-essentialist.[4] Young children operate with a kind-based classificatory scheme. Their inductive thinking is guided by kind-relative distinctions between superficial properties ("accidents") and deep explanatory properties that are supposedly common to members of a kind. Ostensibly deep explanatory properties common to members of a kind are the ones that are quickly generalized, often from a single instance to the whole kind. Accidents such as color, location, posture, and orientation are not so easily generalized.

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[4] Gelman, *The Essential Child: Origins of Essentialism in Everyday Thought* (New York: Oxford, 2003).

Another aspect of our earliest conceptual scheme is less remarked upon in empirical psychology. Even quite early on, our conceptual scheme provides readily available judgments of increase in size versus mere adjoining or juxtaposition. When cream is mixed into a soup, it is understood to become part of the soup, so that the soup becomes more voluminous. When a person gets on a bike, neither the bike nor the person is seen to increase in size. The person does not acquire the bike as a part, nor vice versa. And there is no *salient* third object that has both of them as parts. The same with a ship and a barnacle, a head and a hat, and a dog and a collar. With very little prompting, we readily distinguish being placed on, or being attached to, from becoming part of. It is as if we are primed to experience the environment in a manner guided by rough and ready knowledge of kind-based principles of unity. For we know, as it were in advance, that mere juxtaposition or attachment or the like are not relations that make their relata constitute certain kinds of whole. Even a relatively young child would not be impressed by the following consideration, which has passed in certain quarters as a premise in a philosophical argument. If gluing the parts of a model airplane by together makes them parts of a whole, then gluing two people together should make them parts of a whole. For that thought seems to neglect the kind-relativity of principles of unity. (Whether it is true is another matter.)

The quasi-hylomorphic features of our conceptual scheme may be further shown by our noncollusive agreement over which parts of an object are its ordinary parts, as opposed to parts disclosed only by an arbitrary principle of division of the item. The wheel of the bicycle is readily regarded as a part of the bicycle, less so with the left half of the wheel. We treat objects as if they had relatively privileged decompositions into parts, as if there were a real distinction between a principle of unity for any such object and a mere arbitrary principle of division of the object.

These are rough and ready empirical claims, some of them well supported by evidence, others no better than plausible speculations.[5]

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[5] For an experimental exploration of hylomorphic elements in our conceptual scheme, see Sandeep Prasada, Krag Ferenz, and Todd Haskell, "Conceiving of Entities

To the extent that these empirical claims are true, it might seem that philosophical Essentialism and Hylomorphism may be easily debunked There are quasi-essentialist and quasi-hylomorphic elements in our conceptual scheme These represent functional ways of coping with an environment that can be usefully modeled in essentialist and hylomorphic terms But it is a philosophical error to project these aspects of our model of the environment onto the environment itself

Maybe so, we shall have to see For now, it is best to keep a lively sense that what is presented as philosophical Anti-essentialism is often the unwitting displacement of Essentialism onto a restricted domain Perhaps the manifest kinds we find salient are merely nominal kinds, in the sense that their members do not share an essence But that is very far from the thought that there are no real kinds, kinds whose members do share an essence type, in the sense of the same principle of unity and the same type of parts Perhaps tigers do not form such a real kind, but what of isotopes or electrons? And what of sets, properties, propositions, and possible worlds, do any of these form real kinds?

Indeed, whenever a theorist talks of projections of essentialist aspects of our conceptual scheme onto the environment, we should ask about the framing elements in the theorist's hypothesis of projection These elements include our concepts, the putative acts of projection, and the real, perhaps unknowable, things in the environment Do any of these items make up real kinds united by common essences? Does the theorist feel, or even fall into, the temptation of treating these items as if they had an essence or real definition? (Does he, for example, provide a very elegant theory of nominal essence in terms of multiple counterpart relations among items existing in different possible worlds, and then take great care to set out just *what it is to be* a possible world? Then this is not to provide a totalizing theory of nominal essence, one that leaves no room for real essence It is, in effect, to unwittingly imply that the worlds have real essences, but not the individuals in them And once the worlds are granted real essences, then the modal account of *their* essence will look unhelpful [6])

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as Objects and Stuff," *Cognition*, LXXXIII (2002) 141–65, as well as Prasada and Elaine M Dillingham, "Principled and Statistical Connections in Common Sense Conception," *Cognition* (forthcoming)

[6] Compare David Lewis, *On the Plurality of Worlds* (New York Blackwell, 1986), particularly the discussions of counterpart theory and the account of what it is to be a possible world Lewis characteristically insisted on the relativization of questions of essence to different counterpart relations across worlds, but in his wonderful book, he in fact offers a real definition of a possible world, a real definition which is not naturally

In any case, the exploration of Hylomorphism that follows may be of some interest to the inveterate Projectivist He or she can think of it as a philosophical idealization of a possibly significant feature of our conceptual scheme

Myself, I think that Hylomorphism captures one aspect of the implied ontology of our conceptual scheme, and may be useful in the development of a fundamental ontology, especially so in culling some of the many categories spoken of in contemporary philosophy This is because Hylomorphism provides some philosophical apparatus that enables us to get to the base of some of our unreflective thoughts about complex wholes

We shall also find that Hylomorphism allows a reasoned respect for our folk ontology Here, as elsewhere, our unreflective affirmations can be saved, but only at the cost of reconsidering our unreflective denials This, in its turn, will bear on the invidious distinction

VI TYPES OF PRINCIPLES OF UNITY

A form or principle of unity may be self-maintaining, in that the causal explanation of its holding of some parts will appeal to its having held of those parts So consider again a hydrochloric acid molecule what it is for that molecule to be is for there to be a positive hydrogen ion and a negative chlorine ion bonded together in a bipolar bond The bonding pattern is the principle and the ions are the parts But notice that thanks to the bonding and consequent electron transfer the ions are kept proximate and bonded together In such a case, the principle of unity sustains its own holding Similarly with the bonding of carbon atoms making up a diamond, the interatomic tetrahedral bonding is self-maintaining, in that it provides for a hardness, toughness and rigidity that preserves that very pattern of interatomic bonding

A form or principle of unity may be *static*, in that its holding of certain parts requires that the parts it holds of remain as they are, and remain ordered as they are So consider a word-token, certain token letters arranged in such a way as to spell the type of word in question Changing or rearranging the letters will not preserve the identity of the word-token

A form or principle of unity may be instead be *dynamic*, in that its holding of certain parts may allow or require that the parts it holds of vary over time, either by those very parts undergoing intrinsic

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tied to any counterpart relation Given this, Lewis was, perhaps unwittingly, a crypto-essentialist, in the old, absolutist sense of "essentialist " An essence, properly understood, is what Lewis is attributing to his possible worlds in his discussion of what it is to be a possible world change, or by their being replaced with parts of the same kind, or by their being shed without replacement A paradigm case is a living thing whose organic matter is unified into an organism by some categorical basis of a multi-track disposition to such life-functions as ingestion, assimilation, excretion, growth, metabolic repair, and so on and so forth In this case, the principle of unity is a complex structure of biochemical relations, whose holding of the organic matter of the living thing provides the categorical basis for the multi-track disposition in question The operation of that disposition *requires* the matter to be exchanged over time So the principle of unity of a living thing is dynamic, in that its holding of the parts of the living thing requires that the living thing's matter be exchanged over time

VII MATERIAL OBJECTS

Material objects (middle-sized, naturally occurring, relatively compact, nonliving physical systems) are not mere bundles or sums of matter They are materially structured matter-structurers That is, thanks to their material structure at one time, most of that structure is likely to survive immediately after, at least in their typical environment This turns out to be how they body themselves forward in time So much is revealed by chemistry and the science of materials more generally A material object's structure confers on it a disposition to maintain the material structure that is the categorical basis of this very disposition This is the sense in which material objects have self-maintaining principles of unity

As a result, material objects are relatively cohesive They maintain themselves even while being moved around in their typical environment When they are not too small and not too large they can be visually tracked and manipulated Hence they are, along with persons, animals, and artifacts, among the most salient topics for thought and reference

Once material objects are construed not as mere bundles of matter, but hylomorphically, the answer to the disputed question of whether there can be two material objects in the same place at the same time throughout their entire respective careers is obvious It simply requires distinct principles of unity that happen to hold of the very same parts for the very same period of time

That might happen this way There could be superdense spheres which attract each other with magnetic forces so as to bind together to form something approximating a cube The cube represents a physical system, its parts are the spheres, and its principle of unity is that they should be bound together in a cube by magnetic forces But coexisting with this magnetic system is a gravitational system, one with the same superdense spheres as parts and a different principle of unity, namely that the spheres should be bound together in a cube by gravitational forces

To confirm that these are indeed distinct physical systems, we need to have a clear case in which one could exist without the other Suppose the spheres gradually demagnetize, so that the magnetic forces that hold between the spheres eventually diminish to zero The magnetic system is no more, but the gravitational system remains intact, the superdense spheres continue to be bound together in the cube by gravitational forces

Nor should we say that talk of such physical systems is really talk of the spheres during a phase, such as while they are magnetically bound together, or while they are gravitationally bound together At least we should not do this without being prepared to take the same dismissive view of all material objects For a material object is just a middle-sized, relatively compact, nonliving (and perhaps nonartificial) physical system

VIII DISTINCT PRINCIPLES CAN MAKE FOR COOCCUPANCY

Are there other cases, besides the imagined cube, where two wholes have the very same parts united by distinct principles of unity?

Consider the spork, a camper's implement that combines the functions of a spoon and a fork Think of it as having a bowl at one end and tines at the other[7] You can make a spork in several ways You can take a metal fork and hammer down the nonworking end and then fashion it into a bowl that will serve to spoon up food and liquids Or you can take a metal spoon and cut thin rectangles out of its nonworking end so as to create the tines that will serve to *spear* food (We are camping, remember) Or you can cast the item outright By whatever route, the result is arguably a fork and a spoon and a spork, all in the same place at the same time

I say this with full consciousness of the fact that in some quarters the case of the spork, the spoon, and the fork will excite the temptation to treat these supposedly distinct items as only some one underlying item arranged spoon-wise and fork-wise, and hence spork-wise The most plausible underlying item will be a physical system or structure But this temptation, like other temptations, is inherently general It involves a readiness to treat like cases alike That would mean that we are to treat all artifacts as phases on underlying physical systems And the physical systems themselves, are they any more than phases on some underlying matter? But that is a move toward fundamental ontology, toward revamping our conceptual scheme, rather than explicating it

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[7] I am now told that what passes for a spork in the U S is a spoon with tines cut into half of its bowl Let the reader decide whether I can keep the term "spork" for my imagined item with a bowl at one end and tines at the other, if not, I will be forced to speak of *foons*

Let us restrict ourselves to sporks made in the third way, by being cast outright Consider one such, and its coextensive spoon and fork They came into being at the same time and they have common parts The common parts of the spork, the spoon and the fork are the bowl, the stem, and the tines The bowl is an unusual design feature of the fork, while the tines are unusual design features of the spoon The bowl is a contingent part of the fork, it could be hammered back into a more familiar, nonworking end, as a result the fork (but not the spoon) would survive the change The tines are contingent parts of the spoon, they could be snipped off and the spoon (but not the fork) would be truncated, but it would survive the change So the spoon and the fork are distinct items, since one could exist without the other Yet we can imagine a case where they always have the same parts, the tines, the stem, and the bowl

Notice how the idea of a principle of unity helps explain this case, a case of three things with common parts, but with different (kinds of) essential and accidental parts The spoon is the stem, the bowl, and the tines united by a dynamic principle of unity, roughly the principle that *these parts or most of them or functional replacements of most of them should be arranged in such a way as to be able to function as a spoon* So although the principle holds of the tines, its holding of them depends not at all on their being tines as opposed to something that can be grasped in order to spoon up food or liquid The fork is the stem, the bowl, and the tines united by a different dynamic principle of unity, roughly the principle that *these parts or most of them or functional replacements of most of them should be arranged in such a way as to be able to function as a fork* So although the principle holds of the bowl, its holding of the bowl depends not at all on its being a bowl, as opposed to something that can be grasped in order to mash and spear and scoop up food

By thus filling out the principle of unity for an item we can come to understand how it is that the item has some of its parts (or some of its part types) accidentally, and others essentially Consequently, we can understand how two items can contingently share all their parts

There is another sort of contingent part sharing, one in which there are two things with the same parts, although one of these things could grow or acquire an extra part that would count as part of it, but not of the other thing with which it formerly shared all its parts To modify an example of Saul Kripke's In the Australian desert there is a particular kind of rootless tumbleweed that will only flower after a flooding rain Many of these tumbleweeds die without ever being graced by a flower For their whole sad lives, they consist simply of a spherical stem structure But even such a sad tumbleweed is not identical with the stem structure which happens to exhaust its parts For if the tumbleweed was to flower then the flower would be part of the tumbleweed but not part of the stem What is happening here?

I say that there are two similar but distinct principles of unity in play, the one governing the stem structure and the other governing the tumbleweed Plant biologists could tell us more about these similar but distinct principles of unity, operating at different levels of organization within the plant organism But we can still understand the part sharing arrangement between the stem structure and the tumbleweed without these details

Suppose the stem structure has jointed parts branching off each other They count as parts of the stem because they are organically unified in a way appropriate to making up a stem But they also count as part of the tumbleweed because they are organically unified in a way appropriate to making up a tumbleweed That is why the parts of the tumbleweed are parts of the stem structure and vice-versa Were the tumbleweed to flower, the flower and the jointed parts of the stem would then be organically unified in a way appropriate to making up a tumbleweed Still, the flower and the jointed parts of the stem would not be organically unified in a way appropriate to making up a stem structure

Notice that, as with the sporks, spoons, and forks, the fundamental ground for the distinctness of the tumbleweed and the stem structure is not modal It lies in their distinct principles of unity, which allow for different kinds of variability in the parts of which they hold Here, as elsewhere, modality is consequential upon essence and accident[8]

IX DISTINCT PRINCIPLES MAKE FOR COUNTEREXAMPLES TO WIGGINS'S THESIS

John Locke wrote "We never finding, nor conceiving it possible, that two things of the same kind should exist in the same place at the same time, we rightly conclude that, whatever exists anywhere at any time excludes all of the same kind, and is there itself alone."[9] Following Locke, David Wiggins claimed that although there could be several material items in the same place at the same time, there could not be two material items of *the very same substance kind* in the same place at the same time.[10] A material item (a quantity of stuff or a material object or an artifact, or, more controversially, an animal or a person) will have only material parts. So it will be interesting to inquire whether there could be two material items of the very same substance kind and with the very same material parts throughout their coextensive careers.

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[8] As Fine has reminded us in a series of important papers, see, for example, "Essence and Modality," in James E Tomberlin, ed , *Logic and Language Philosophical Perspectives*, Volume III (Atascadero, CA Ridgeview, 1994), pp 1–16, "The Logic of Essence," *Journal of Philosophical Logic*, xxiv (1995) 241–73, "Senses of Essence," in Walter Sinnott-Armstrong, ed , *Modality, Morality, and Belief* (New York Cambridge, 1995), pp 53–73

This question, like Locke's claim and the Wiggins Thesis, is systematically underspecified thanks to the lack of specificity of 'very same kind'. For that phrase can admit of a variety of restrictions. Are not poodles all of the very same kind? Well, there is the Standard Poodle and the Miniature Poodle. But is that a difference in kind? Well, the difference between the English Racing Greyhound and the Whippet is a difference in kinds of breeding (the Whippet is related to both the English Greyhound and to the Terrier) and hence a difference in breed. Is that not a difference in kind?

Notice that these are all substance kinds in Wiggins's sense. That is, they are each such that members of the kind cannot migrate out of the kind. Once a Standard Poodle, always a Standard Poodle. But as to what makes for a difference in kind or even in substance kind, we still do not know, because as yet there is nothing definite to be known. We need to specify what we mean by a kind.

A worthwhile form of the question about same parts and same kinds focuses on what was once called *infima species*, kinds that have no subkinds, and so are the most specific of kinds. Items are members of the same *infima species* if they have just the same fully determinate essence, hence just the same principle of unity, and at the most specific level of sameness.

Could there then be two material items of the very same utterly determinate kind with the very same material parts throughout their coextensive careers? What would make them distinct? Their principles of unity would be the same and their parts would be the same. (Moreover, since by hypothesis they are entirely coextensive in space and time, they presumably came into being from the same material origins.)

Nevertheless, if we allow ever so little determinability in the kind in question, and hence some difference in the principles of unity in question, then we can find two material items of the very same kind with just the same parts (and in the very same place) throughout their entire careers

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[9] *Essay concerning Human Understanding*, II, xxvii, 1.

[10] Wiggins, "On Being in the Same Place at the Same Time," *Philosophical Review*, LXXVII (1968): 90–95.

X THE BEGIN HIGHWAY

Consider road signs, their parts, namely "signage" and word-tokens, are material, even though their principles of unity involve intentional conditions What a road sign can reasonably be expected to convey to passersby enters into the identity of the sign, it is part of what it is to be the sign in question So if the same physical piece of signage first says "Roadwork Ahead" and then is repainted to say "Eat at Joe's" we have two different signs made of the same piece of signage and different word-tokens They also differ in what the signage and the tokens can be reasonably expected to convey It is not a contingent feature of a sign (as opposed to a piece of signage) that it warns rather than exhorts

Even so, the principle of unity for a sign seems to be dynamic, in that the same sign can survive some change in the word-tokens displayed upon it So if we begin with a piece of signage that says "Eat at Joes" and the sign-maker later feels the need to correct his spelling by adding the apostrophe to indicate the possessive, so that the sign now reads "Eat at Joe's" then this is the same sign, now corrected

A sign can survive augmentation of its constitutive word-tokens, as well as their correction Having corrected the spelling in the sign, the sign-maker may feel that "Eat at Joe's" is just too unemphatic, and may add an exclamation mark to compensate So it is the same sign that first says "Eat at Joes" then "Eat at Joe's" and finally "Eat at Joe's!" Each of the three sequences of tokens can be reasonably expected to convey the same message to the passerby

So what it is for a road sign exhorting passersby to eat at Joe's to exist at a certain place along a highway is for there to be at that place some signage visibly displaying (possibly varying) word-tokens that may reasonably be taken to convey to passersby that they should eat at Joe's

Now consider the (fictional) story of the Begin Highway Between Haifa and Tel Aviv a highway is to be built in the generic American style with all the usual entries, exits, crossovers, landscaped banks, and, of course, the ubiquitous green and white signage in English The friends of Menachem Begin wish to memorialize Begin by naming the highway after him So they pay a Mr Janus, who is in the business of building and maintaining signs, to put up a green and white sign naming the highway the Begin Highway

It so happens that Janus is the very same man contracted by the highway builders to put up the usual signage around the highway And this calls for, among other things, a green and white sign indicating the start of the highway, a sign saying, as they do, "Begin Highway."

Janus thinks it will be frustrating to many motorists to see one English sign naming the highway the Begin Highway as well as another indicating where the highway begins. He thinks that some motorists will say "Enough already with all this Begin stuff!" while others will be thoroughly confused as to where the highway really begins. So Janus forms the plan to use the very same piece of signage and the very same word-tokens to both name the highway after Begin and to indicate where the highway begins. He thus produces two signs in the same place at the same time, and there they remain throughout their careers. The one sign, the "Begin Highway" sign, names the highway and so carries out the communicative intentions of the friends of Begin. The other sign, the "Begin Highway" sign, indicates where the highway begins and so carries out the communicative intentions of the builders of the highway. The friends of Begin drive by and only see the first sign. Most other motorists only see the second. I mean they all see the signage and the word-tokens, but only some see it as naming the highway.

The friends of Menachem Begin eventually come to realize what has happened, and they are furious with Janus. They say "The highway company paid you to put a sign there and we paid you to put up a sign there, but there is only one sign there." Janus demurs. He argues as follows:

> There must be two signs there. For I could make either one cease to exist by augmenting the other. I could prefix the first word-token on the piece of signage with 'M.' and then since the signage would now read "M. Begin Highway" it could not be reasonably taken to indicate where the highway begins. By changing the signage in this way I would have augmented the sign that names the highway and caused the other sign to cease to exist. Now you can't augment something that doesn't already exist. So the sign that names, the sign you paid me for, has been there all along.
>
> Notice that I could instead interpolate 'the' between the word-tokens on the piece of signage and then since the signage would now read "Begin the Highway" it could not be reasonably taken to name the highway after Begin. By changing the signage in this way I would have augmented the sign that indicates where the highway begins and caused the other sign to cease to exist. Again, you can't augment something that doesn't already exist. So the sign that indicates, the sign they paid me for, has been there all along.
>
> So there have been two signs there all along.

Janus is ready to let the distinctness of the signs simply rest on a modal argument We, however, are in a position to see what grounds his modal argument, namely the proper hylomorphic account of what it is to be this or that sign The essence of this sort of sign requires that word-tokens be displayed on the signage for some communicative purpose Given different communicative purposes, different sorts of variability in the word-tokens will be allowed for by the two different principles associated with the two signs Hence, the two signs can contingently (and forever) share the very same parts, and yet be distinct thanks to these different principles

Although I think that this is what makes Janus right about the distinctness of the road signs, my point is not to insist that there are two signs there, as opposed to one sign doing double communicative duty The point is instead a conditional one To the extent that we think that there is more than one sign we must think that the principle of unity for the sign that names is different from the principle of unity of the sign that indicates It cannot be that what unites the word-tokens and the piece of signage into a road sign is just that the former is painted on a visible part of the latter It must rather be that the tokens should be painted on the signage with the reasonable expectation that they convey to passersby that the highway is named after Begin, or alternatively, with the reasonable expectation that they convey to passersby that the highway begins near the sign Absent something like this more demanding principle of unity for signs, there is no distinguishing the signs

For given a single utterly specific principle of unity and just the same material parts at the same times, there is no discerning two material objects with that principle and those parts So there is no discerning two material objects of the very same *infima species* with the very same material parts throughout their coextensive careers But if the location of a material object is wholly determined by where its material parts are located then a version of the Wiggins Thesis follows There is no discerning two material objects *of the very same infima species* in the very same place throughout their entire careers

Fine has a similar example, two distinct letters consisting of the very same orthographic tokens on the very same paper [11] One letter is in English and the other is in Code The two missives achieve different communicative effects Fine takes this to be at odds with the Locke/Wiggins Thesis As we have seen, it is and it is not at odds with the Locke/Wiggins Thesis Everything depends on how we construe 'same kind' as it figures in the Locke/Wiggins Thesis What is clear is that coextensive missives in English and in Code will have different principles of unity governing the same orthographic tokens Something of the spirit of the Locke/Wiggins Thesis, as well as the ambiguous letter of the Locke/Wiggins Thesis, is certainly compatible with that

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[11] Fine, "A Counterexample to Locke's Thesis," *The Monist*, LXXXIII (2000) 357–61

XI AGAINST UNIQUENESS OF COMPOSITION

A commitment to Hylomorphism undermines the general claim of uniqueness of composition, the so-called "axiom" that distinct wholes must have distinct parts This is because distinct principles of unity can be another source of distinct wholes

A theorist might try to save the "axiom" of uniqueness of composition by treating a principle of unity as another sort of part, a property-part So consider a molecule On the theorist's conception, the parts of the molecule would be atoms *and* the relation of being bonded together This "property-part" would be what distinguishes this molecule from other wholes with the just the same ordinary parts, for example, the mereological sum of the atoms

The conception takes some getting used to We ordinarily think that all the parts of a material object lie on or within the surface of the object If we extend this requirement to property-parts then we will get the absurd result that relations like being bonded together can be approached So the friend of property parts will have to get comfortable with the idea that property parts are not within the material objects they are part of Indeed, they had better not be in spacetime at all For one cannot make sense of anything getting closer to some property Properties, relations among them, are unapproachable

On this conception of relations as property-parts, each material object will share parts with some state (at least if states are understood as structured complexes) So, if what it is for a certain cross to exist is for one plank to be attached to another at right angles then on the conception in question the cross consists of the planks and the relation of being attached at right angles But those same constituents will be parts of a certain state of the planks, namely, the state of the planks being attached together at right angles

This illustrates the central difficulty with the conception The principle of unity for the state is distinct from the constituent relation of the state, the principle of unity in question requires that the constituent relation be instantiated by the constituent planks But on the conception of objects as having their own principles of unity as parts, it will often be true—and this is fatal to the conception—that the principle of unity will not hold of itself and the other parts of the object So it is with being attached together at right angles This is a relation that could not possibly hold of three things, one of which is a relation

So also with bonding, a principle of unity for bonded units such as molecules What is it for this property-part, bonding, along with the ordinary parts, to make up a genuine whole, the whole that is the molecule? The holding among the ordinary parts of a principle of unity, being bonded together, was supposed to account for why the ordinary parts made up the whole that is a bonded unit But it does not account for why the ordinary parts and the property-part make up such a whole For being bonded together could not possibly hold of three things, one of which is a relation

Suppose some other relational property *R* held of the property-part and the ordinary material parts, and it was in virtue of the holding of that relational property of all these parts that all these parts formed a genuine whole Well then, it is *R* and not being bonded together that is the principle of unity that we seek So if *R* is the principle of unity, the present conception will count *R* as another part, alongside the ordinary parts

The obvious problem is that there will be no general guarantee that *R* holds of all the parts *and itself* Unless *R* is such as to hold among all the parts and itself, it cannot be the principle of unity that we seek For since it is itself supposed to be a part, then it should hold of all the other parts and itself Otherwise there would be no account of what in virtue of which *all* the supposed parts form a whole There just will not be such "autological" relational properties for all of the various kinds of complex objects that there are If *R* is the variably polyadic property of this, that and the other parts existing at some time or other, then *R* could hold of itself But as soon as we entertain more demanding principles of unity, this special feature disappears

This is the crux of the difficulty with the conception of principles of unity as further parts of the objects they govern The relational properties that are the plausible "uniters" of ordinary parts into complex objects will not in general hold of the ordinary parts and the relational properties themselves There is therefore no basis for including them as parts along with the ordinary parts in some putative object

There is one last embodiment of the conception that is worth considering It is this Let in as property-parts of items what we have been taking to be principles of unity, and then give an entirely uniform answer the question of what relation must hold between the property parts and the material parts (the form and the matter, if you will) for them to make up a whole The uniform answer will just be that the form or property parts be appropriately *instantiated* by the material parts

But to what purpose? The theorist now has a picture on which the principle of unity for any complex item is always instantiation And *that* principle of unity is never included as a property part of any item Or at least it had better not be, on pain of an ugly, part-generating regress, one involving such embarrassing things as a three-place relation of instantiation holding among a two-place relation of instantiation, the material parts, and the formal parts

The theorist may say that she is simply granting instantiation a special status, and will not include *it* as a property part She may then seem to have saved uniqueness of composition, the "axiom" that distinct wholes have distinct parts, if not distinct material parts then distinct property parts And that, at least, may appear to be a worthy purpose But upon analysis, the proffered conception of property parts still faces some difficulties, and in the end it also fails to secure uniqueness of composition

The principle of unity of some whole may be a relational property, and so on the proffered conception, it will be factored in as a property part of that whole Now it is appealing to think of relational properties themselves as wholes that involve relations which are partially saturated by individuals or properties, wholes whose parts, in the extended sense, are the original unsaturated relation and the individuals and/or properties which partly saturate that relation So conceived, the U S mint is a part of the relational property

> *x*'s having been applied to *y* at the U S mint in conformity with the dollar bill pattern

Notice that this relational property might function as the principle of unity of a particular U S dollar bill, understood as certain quantity of ink and a certain piece of paper being so related (Artifacts often have principles of unity involving material items extrinsic to them) Include that principle of unity as a part of the dollar bill, and the U S mint will turn out to be a material part of the dollar bill, or at very least, a material part of a part of the dollar bill This is a result to be avoided, for even if the U S mint were totally destroyed, no material part, immediate or remote, of the dollar bill would be destroyed

That is something of a difficulty, but it is not the main problem for the conception of wholes as including formal as well as material parts For if there can be two wholes with the very same material and formal parts then the conception simply fails to achieve its motivating purpose of saving the "axiom" that distinct wholes have distinct parts To see this consider the individual HCl molecule and these items

> The set consisting of the ions and the relation of bonding
>
> The mereological sum consisting of the ions and the relation of bonding

While there might be something to be said for disbelieving in one or another of these two items, it is hard to do without both On the conception under scrutiny, they share their property parts and their material parts with the molecule But neither the set nor the sum is the molecule They could exist even if the molecule did not And it will not help to add instantiation to the sum or the set, for the neither the augmented set nor the augmented sum will be the molecule [12]

So, given Hylomorphism, the "axiom" that distinct wholes must have distinct parts is not an appealing collateral thesis We should give up on the generalized principle of uniqueness of composition

Here we might note one awkward question that the foregoing raises for those ontologists attracted either to the idea of material objects as bundles of properties, or to the weaker idea that properties are among the parts of such objects If there is no basis for including the principle of unity of a given object as a property-part of that object then will it not seem odd to include the other properties of the object as property-parts of that object? How is it that the relation or relational property that enters into the essence of an object is not part of that object, while the accidents of the object are parts the object?

Better to recognize that material objects are wholly spatiotemporal, in that all their parts are located in space and time In this respect, they contrast with states, events, facts, and propositions, structurally conceived Whereas these have properties as parts, material objects do not

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[12] Our theorist might look ahead and make something of a thought to come, namely that the principle of unity of a set is that its members exist So the principle of unity of the set of the relation of bonding and the ions is just that the relation and the ions all exist Why then not be true to the conception of forms as parts and treat the parts of a set as going beyond its members to include also the principle, namely, the variably polyadic relation of them all existing So the set of bonding and the ions will have the obvious three parts and also have the variably polyadic relation of coexisting as a part Now the set does have different parts from the molecule!

Forget the oddity of the conception so elaborated The thing to notice is that it is extensionally inadequate because a different set, namely the set of bonding and the ions and the variably polyadic relation coexistence, will then have the very same parts as the set of bonding and the ions The variably polyadic relation coexistence cannot be included "twice" in the set

XII ONTOLOGICAL DEPENDENCE AND ITEM-GENERATING FUNCTIONS

Hylomorphism was stipulated to be the thesis that the real definition of each complex item is to be given in terms of its parts ("matter") and principle of unity ("form"), where to give the real definition of an item is to state its essence Associated with the ideas of real definition and essence is the idea of the ontological dependence of one item on another, where an item *x* is ontologically dependent on an item *y* just when *y* features at some point in the full account of the essence of *x* (the real definition of *x*), but not vice versa The full account of the essence of a complex item would involve its complete hylomorphic decomposition, so that when an item's parts turn out to be a complex, the account will include the parts' own principles of unity (forms) and genuine parts (matter), and so on and so forth, either *ad infinitum* or terminating in simples (The infinite case shows that the full account of the essence of an item is best understood as an abstract entity that we might only be able to capture in part)

So, to continue to operate on the level of ordinary examples (examples which a more fundamental ontological theory might impugn), my left fist is intuitively ontologically dependent on my left hand First, what it is for my left fist to be is for my left hand to be clenched Being clenched can here be thought of as a minimal case of a principle of unity, a monadic property applying to my left fist's single immediate part, my left hand Second, whatever the full account of the essence of my left hand turns out to be, it will not involve mention of my left fist So, by the proposed criterion, my left fist counts as ontologically dependent on my left hand[13]

That may seem to be the general case with Hylomorphism In each instance a hylomorphic complex may seem to be ontologically dependent on its genuine parts, the parts related by its principle of unity Those parts figure in the real definition of the whole, and since they could be around anyway without making up the whole, the whole will not figure in the real definition of the parts Hence Hylomorphism seems to sit well with the thought that the whole is always ontologically dependent on its parts

We can put that thought in terms of the idea of an "item-generating function " Whenever some *n* items are the genuine parts of an item *x* whose principle of unity is the *n*-ary relation *R* there will be a function *F* based on *R*, a function from the *n* parts to the item *x* Let us say that such a function is an item-generating function just when *x* is ontologically dependent on the *n*-parts

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[13] Ordinary ontology is often rather detailed, and it is sometimes instructive to trace its lineaments Mike Tyson's right fist is now twelve inches across That could be true even if he is not now making a fist In general, one might want to distinguish my left fist (one of the *two* fists that I *have*) from the many fists I have *made* on various occasions The two fists I have, like the fists I make, are ontologically dependent on my hands, but in a more complex way Their reality appears to consist in the possibility of my making fists with my respective hands

So, we might think that there are item-generating functions such as "event-builders" and "group-builders "

Event-builders work like this An event, such as the stabbing of Caesar by Brutus in the senate, may be thought of as a complex item, having constitutive individuals, such as Caesar and Brutus, a constitutive property, such as the relation of stabbing, and a constitutive spatiotemporal region, the space-time region in which the event occurred The principle of unity for the event is the constitutive individuals standing in the relation in question, in the case at hand, Brutus stabbing Caesar at a certain time and place Associated with this principle of unity is a function from Brutus, stabbing, Caesar, and the spatiotemporal region to the event of the stabbing of Caesar by Brutus This function is plausibly taken to be item-generating, for the event in question seems to be ontologically dependent on the constitutive individuals, property and region

Group-builders work like this A group, such as the Australian Council of Trade Unions, the ACTU, may be thought of as a complex item including as its components such groups (so we may suppose for the sake of our example) as the Fitters' and Turners' Union and the Dock Laborers' Union In this case, the principle of unity of the group requires that the constitutive unions enter into certain legally sanctioned relations of cooperation Associated with this principle of unity is a function from the constitutive unions to the ACTU This function is plausibly taken to be item-generating, for the ACTU seems ontologically dependent on its constitutive unions, it comes from them thanks to their entering into relations of mutual cooperation

This is the common case, but is it the only case? Not if the origins of an item enter into what it is to be that item Suppose that the ACTU acquires the legal right to create unions, and then incorporate those unions into itself So the ACTU creates the Bank Tellers' Union, and then allows it to join the ACTU There is no difficulty with the hylomorphic model of the ACTU, the unions are its constituents, and its principle of unity may even be explicitly promulgated by law What is threatened by the example is the idea that associated with this principle of unity is an item-generating function For suppose an item's origins enter into the essence of that item In the case at hand, that amounts to supposing that the Bank Tellers' Union is essentially a group formed by the ACTU, that is, if the same bank tellers had begun their union without the intervention of the ACTU we would have a different union. Then, since the event of being formed by the ACTU constitutively involves the ACTU, the full account of the essence of the Bank Tellers' Union will involve the ACTU. So the ACTU is not ontologically dependent on its constitutive unions.

The same situation can arise in the case of events. Consider the conception of Caesar. First, it is an event that constitutively involves Caesar along with his parents or generators, whatever they were. But second, it arguably enters into the essence of Caesar. Caesar is essentially someone generated in that very way. Then the full account of the essence of Caesar would involve the event that was the conception of Caesar. So that event is not ontologically dependent on Caesar. Yet Caeser was a part of that event, in our extended sense of part.

So also with living things and those living parts which develop in them. Consider my left upper incisor. Arguably, part of what it is to be that very tooth is to be a tooth that grew into my mouth. (Well, of course, I am leaving certain gruesome possibilities aside. So, more exactly, I suppose that my left upper incisor had to develop *somewhere* in my body. The point is that it, that very tooth, could not have originated, say, by growing out of the forehead of Dick Cheney. And this is not a particular defect in the Vice President, nor in his forehead.) My body enters into the account of what it is to be that very tooth. The same with my bones, arguably they are essentially bones which grew in my body. The same with my flesh. Yet my body may be taken to be no more than this flesh and bones (matter) held back from corruption by certain metabolic processes which they together support (form). No doubt, that is an archaic and inadequate account of my body's matter and form. But the thing to notice is that if such an archaic account of the matter and form of my body were correct, my body would not be ontologically dependent on my flesh and bones.

The upshot is that not every principle of unity need be associated with an item-generating function. Hylomorphism does not itself entail that the hylomorphic whole is ontologically dependent on its parts. There can be genuine parts that are not independent of the whole.

So, for example, a Cosmic Monism, the thesis that there is one thing, the Cosmos, on which all else is ontologically dependent, need not entail that this one thing is simple, in the sense of not having parts. It only entails that the full account of what it to be those parts must mention the one thing. Thus a version of Cosmic Monism might hold that the many material items within the Cosmos are all such that it lies in their essence to emerge in this Cosmos, just as it lies in the essence of my incisors to emerge in me.

A similar observation applies to Classical Theism, which conceives of God as the first being, a being on which everything else is ontologically dependent, and so a being which is not ontologically dependent on anything else. As it is said, the first being is *a se*, from itself and from no other. In the tradition of Classical Theism, a paradoxical consequence has been drawn from this, namely that God is utterly simple, so that his essential attributes must all be identical, *and be identical with him*. The canonical from of this argument from "aseity" to divine simplicity is given by Aquinas in *Summa Theologica*, 1.3.7, immediately after offering his famous "five ways" to the existence of God.

> Every composite thing is posterior to its components and dependent on them. But, as was shown above, God is the first being.

So the first being cannot be in any way complex. Aquinas goes further and argues that even the complexity that comes from the distinctness of the existence of a thing and what that thing is, that is, its essence or essential attributes, cannot be found in the first being.

> In every simple thing, its being and *that which it is* are the same. For if the one were not the other, simplicity would be removed. As we have shown, however, God is absolutely simple. Hence, in God, being good is not anything distinct from him, he *is* his Goodness. (*Summa Contra Gentiles*, 1.38)

And the same would hold for his Justice, and for his Power, and for each of his other essential attributes. He *is* his Justice and his Goodness and his Power! His Goodness is just his Power! It follows that God is a single attribute, which can be named as his Power or his Goodness or his Justice![14]

But these paradoxical conclusions only follow given Thomas's false assumption that every composite thing is posterior to its components, and dependent on them.

XIII. CULLING OSTENSIBLE CATEGORIES

Our discussion of the Begin Highway highlighted this consequence of Hylomorphism. Absent a difference in origin, there cannot be two items with the very same parts and the very same principle of unity.

Once a Hylomorphic View of complex entities in whatever category is adopted, this consequence can be used to cull ontological categories, be they folk categories or fundamental categories. For we often work with pairs of categories whose examples exactly match in parts and principles. This can be most readily seen in the case of the categories of the state (event) and the fact, more controversial perhaps, will be the case of the categories of the set and the mereological sum.

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[14] Alvin Plantinga quite plausibly argues that this view of the first being as an attribute makes nonsense of traditional theism, see *Does God Have A Nature?* (Milwaukee: Marquette, 1980).

An initial distinction between facts and states might be made this way: Facts obtain, whereas states hold of their constituent individuals.

On the face of it, states are picked out by nominals with such forms as 'the *F*-ness of *a*', or perhaps '*a*'s being *F*', whereas facts are picked out by nominals like 'the fact that *a* is *F*'. Some philosophers would add to this merely linguistic distinction the observation that states are the *slowest* events, that is they are like events in having constitutive individuals and properties, but unlike them in that the constituent individual's having the constituent property does not necessitate that there is or was a change going on. Whereas something could be red or square or positively charged throughout a period in which it did not change, nothing could be a stabbing of Brutus by Caesar without some change in Brutus and Caesar thereby taking place. Neither states nor events obtain, but facts do. (Events occur. In what follows, I will let states stand in for events as well, the point will be that once we have states and events, there is no room for a basic category of facts.)

Now Stephen Neale, in his comprehensive work *Facing Facts*, has set out a very strong case to this effect. The best way to avoid a trivialization of the notion of fact by way of the "slingshot argument" is to adopt a structural conception of facts, that is to say, a conception of them as complexes built up out of their constitutive individuals and properties.[15] The structural conception of states is equally plausible, states can be understood as complexes built up out of their constitutive individuals and properties.

So far, so good. Hylomorphism implies that there can be distinct items with the very same parts. All that is required is that the items have distinct principles of unity. Indeed, if the principles of unity of the items are sufficiently different, then it may make sense to locate them in different categories.

But given the structural conception of states and facts, the situation seems to be this: for each state, we can find a fact with the very same parts and principle as the state, and for each fact, we can find a state with the very same parts and principle as the state. And the corresponding states and facts will not differ in their origins. (Of course, you might say that facts originate from facts, and states from states, but this is just to move the bump in the carpet) Surely then, talk of the state and the corresponding fact is double counting, there cannot be two items such that the full account of what it is to be the one is identical with the full account of what it is to be the other

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[15] Neale, *Facing Facts* (New York: Oxford, 2000).

To illustrate, consider these respective depictions of the state of an apple's weighing half a kilogram and the fact that that apple weighs half a kilogram, where the distinct bracketing marks the alleged difference between the state and the fact

[The apple, the property of weighing half a kilogram]

{The apple, the property of weighing half a kilogram}

Since the state and the fact have the same constituents, and origins are not differentiating factors, the state and the fact are distinct only if they have different principles of unity Yet there seems to be no difference in principle of unity What it is for the state to exist is not just for the two constituents to exist, but also for it to be the case that the constituent individual has the constituent property What it is for the fact to exist is not just for the two constituents to exist, but also for it to be the case that the same constituent individual has the same constituent property But now Hylomorphism tells us that we are here double counting, one thing is being mistaken for two And the problem is obviously quite general

The only choice that respects the original categorical distinction ("Facts obtain, whereas states hold of their constituent individuals") is to jettison one of the two putative categories of state and fact, at least if both are given a structural treatment

Faced with this choice, we might jettison facts as a basic category because we believe that all the respectable work done by facts can be done by true propositions This remains so even on a structural conception of propositions as complex wholes, at least so long as propositions have different principles of unity from the states to which they sometimes correspond But if propositions are complex wholes, then what is *their* principle of unity? It is a question that has proved difficult to answer

XIV WHAT IS THE PROBLEM OF THE UNITY OF THE PROPOSITION?

Recently, there has been a revival of the so-called problem of the unity of the proposition For example, in his posthumous book, *Truth and Predication,* Donald Davidson continually worries around this problem, suggesting that the problem can be solved, or at least bypassed, by way of Alfred Tarski's definition of truth in terms of satisfaction [16]

[16] Davidson, *Truth and Predication* (New York Oxford, 2005)

The problem of the unity of the proposition may be introduced this way Propositions, if they are anything, are at least what sentences can be used to assert An assertoric use of a sentence is true just in case the proposition asserted is true An assertoric use of a sentence is false just in case the proposition asserted is false So propositions, if they are anything, will be bearers of truth value Now semantics is *inter alia* the discipline of looking for semantically significant subsentential expressions, parts of sentences that can be construed as making systematic contributions to the propositions expressed by those sentences On a structural conception of propositions as complex wholes, it is natural to think of semantically significant subsentential expressions as contributing constituents to the proposition expressed by the sentences in which those expressions figure So, in the simplest case of a subject/predicate sentence, such as

Aristotle liked dogs

we may think of the name 'Aristotle' as contributing the item Aristotle (or alternatively, a mode of presentation of that item) to the proposition expressed by the sentence And we may think of the predicate 'liked dogs' as contributing either a set of all the dog-likers or the property of having liked dogs (or alternatively, a mode of presentation of that set, or of that property) to the proposition expressed by the sentence We will then have two items that are constituents of the proposition, for specificity sake we make take them to be Aristotle and the property of having liked dogs Neither is a bearer of truth value Nor is the mereological sum of these two items a bearer of truth value, nor is the set of these two items a bearer of truth value, nor is the group consisting of these two items, nor is the sequence consisting of these two items None of these things could be true or be false, without the stipulation of some further convention for assigning truth and falsity We can *introduce* a sense in which they might be called "true" or called "false" say by requiring that their constituent property holds of their constituent individual[17] But the arbitrariness of the procedure is brought out by the following question The sum, the set, the group and the sequence are all distinct, yet by the obvious convention they can each be called "true", so which of these true but distinct items is the true proposition that Aristotle liked dogs?

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[17] Of course, in the case of the sum, the set and the group we have no obvious way to generalize to the relational case Only sequences will work for that, but even so, why cannot certain sums like the sum of Aristotle and the property of liking dogs be true, given the obvious convention?

The problem of the unity of the proposition is then two-fold. How is it that items like Aristotle and the property of liking dogs make up some third complex item, the proposition that Aristotle liked dogs, and how is it that a complex item like this, unlike the sum or the set or the group or the sequence of the constituents, is a nonarbitrary bearer of truth value?

The whole force of the problem will now be seen to rest on the idea of a "nonarbitrary" bearer of truth value. What exactly does that idea come to? This obscurity, it seems to me, is what has lead to the neglect of the problem of the unity of the proposition. However, the notion of a principle of unity can be used to explicate the relevant idea of arbitrariness, so as to restore a sense of the problem.

We can divide the propositional constituents of the simplest propositions into *topics* (like Aristotle) and *predicables* (like the property of liking dogs). Topics can be either the referents of singular terms or items in the domain of quantifier expressions. Let us define individuals as topics that cannot be predicated of anything, and allow that properties can be both predicables and topics, depending on the proposition. (As in Liking dogs is a virtue in a dog-catcher.)

Suppose we then say of the sum of Aristotle and liking dogs that it is true just in case the predicable element—the property of liking dogs—holds of the topic, Aristotle. Or suppose we say of the ordered pair of liking dogs and Aristotle that it is true just in case the first member is had by the second. What is wrong with that?

The sum and the ordered pair each have their own principle of unity. In the case of the sum, it is the existence of Aristotle and the property, in the case of the ordered pair it is their existence and their being ordered in a certain way. The crucial observation is this: Such principles of unity do not themselves explain how the wholes that they generate are capable of truth and falsity. So the wholes in question are not the sorts of things that are intrinsically capable of being true or false, that is, capable of being true or false without further convention. We need to associate truth or falsity with sums or ordered pairs by way of a convention, a further rule that is not itself an expression of the principle of unity for the wholes in question. That is why sums and sets and sequences are none of them propositions.

What is the contrast case? What sort of principle of unity would unite topics and predicables in such a way that the resultant whole would be intrinsically capable of taking on a truth value, where which value it takes on depends only on how things stand?

We do know one thing about the relation that has to hold of Aristotle and the property of having liked dogs for them to comprise the complex that is the proposition that Aristotle liked dogs. It has to be utterly undemanding For we want this proposition to exist and have those items as constituents whether or not Aristotle liked dogs For the proposition that Aristotle liked dogs could be falsely believed, and falsely asserted

Moreover, the proposition that Aristotle liked dogs, could be falsely believed and falsely asserted even if it lay in Aristotle's essence to *dis*like dogs, that is even if it was simply impossible that Aristotle liked dogs All that is required is the property of having liked dogs be predicated of Aristotle That is enough for the proposition to exist If we must have propositions, then I favor this "predicational" account of the unity of the proposition Let us now try to see a little further into the idea

Some predicables and topics fit together in the sense that the predicable can be predicated of the topic or topics For one thing, fitting together requires that the predicable have the same number of argument places or "unsaturated positions" as there are topics So being the brother of is not predicable of Aristotle, nor of Aristotle, Socrates, and Plato For another thing, fitting together requires a match of logical type between the argument places in the predicable and the topics, so that the relation of instantiating cannot be predicated of Aristotle and Socrates, because both are individuals Some philosophers might add a third requirement on fit, it must not be a category mistake to predicate the predicable of the topics, as when we (try to) predicate sleeping in of Saturday

An objectivist about predication, one who regards predications of fitting predicables of topics as existing anyway, and not as just the outcome of judgments, might well believe that when it comes to predicability, all the possibilities are realized, predicability guarantees predication Whenever *F*-ness is predicable of *a*, then there will be something that is the predication of *F*-ness of *a* Given that, we can identify the proposition that *a* is *F* as the predication of *F*-ness of *a* We may think of that as a complex item built up from *F*-ness and *a*, by way of the relation of being predicated of

So what it is for the proposition that Aristotle liked dogs to exist is for liking dogs to be *predicated* of Aristotle That is why propositions are so numerous, it is very easy for them to exist

The obvious hitch is that the predication of *F*-ness of *a* may seem to be just the act of judging that *a* is *F* But the objectivist must deny this What the objectivist about propositions needs to do in order to make the present account persuasive is to bring out an act-object ambiguity (or better polysemy) in the use of the term 'predication', rather like the act-object ambiguity in the use of the term 'explanation'

An explanation is sometimes a type of act that I can go in for, as when I explain why I missed the meeting But in doing that, I relate myself and my audience to an objective item, an explanation, which exists even if I do not attempt to explain myself (One may think of an objective explanation as some kind of derivation, deductive or probabilistic, of a proposition expressing the *explanandum* from a proposition expressing the *explanans*) My act of explaining must characterize enough of the objective explanation to count as giving *that* explanation, as opposed to some other objective explanation, or no explanation

Similarly, when I perform the act of predicating *F*-ness of some individual *a*, I thereby relate myself in judgment to an objective entity, the predication of *F*-ness of *a* I judge true the predication of *F*-ness of *a* But this predication of *F*-ness of *a* is just the proposition that *a* has *F*-ness

Just as there are explanations that are too complicated for us to grasp or give, there are predications that are too complicated for us to grasp or judge to be true But the predications, like the explanations, exist anyway They are not mind-dependent entities, even though in order to grasp or believe them we must perform a mental act that corresponds to their structure

Again my point is a conditional one, serving just to highlight what a solution to the problem of the unity of the proposition would look like *If* there are such things as objective predications, then they would be potential bearers of truth value *intrinsically*, in a way that sets or sums or series of topics and predicables are not *For the holding of the very relation that is the condition of unity for the whole that is the predication that a is F, namely that F-ness be predicated of a, itself will guarantee that the whole is a potential bearer of truth value, depending just on how things stand* This is not so with the set, or the sum, or the series The possibility of their being true or false has to be associated with such entities from without, by way of a convention

The predication of *F*-ness of *a* will be true just in case *a* instantiates *F*-ness, and not true otherwise The predication of *F*-ness of *a* is thus intrinsically capable of taking on a truth value, where which value it takes on depends only on how things stand

Should we believe in objective predications, and so in propositions so conceived? Here I take no fixed view But it might be said that we have already helped ourselves to some such notion when we talk of the possibly infinite well-formed formulas of some formal language based on first-order logic For if they are to be bearers of truth and falsity then the well-formed formulas of such a language are not mere concatenations of expressions They must essentially involve predications of predicables (here taken to be mere predicates) of items that are either the referents of singular terms or lie in the domain of the quantifier expressions Such predications are obviously objective They run far beyond any predications users of the formal language might make

As Davidson points out, if we could suppose that we only had to deal with first-order languages, we might follow Tarski's definition of truth in terms of the satisfaction of predicates by sequences, and then seem to have a way of bypassing the problem of the unity of the proposition After all, the sequence <Aristotle> satisfies the predicate 'liked dogs' And without further convention this guarantees that 'Aristotle liked dogs' is true Here Tarski's definition of truth in terms of satisfaction shows how truth is intrinsically associated with the wholes that are *sentences* of first-order languages But notice that this is only so if we are treating the sentences not as mere concatenations of expressions, but as involving such semantic features as the predication of predicates of the references of singular terms The whole Tarskian approach depends on seeing such expressions as 'liked dogs' in sentences like 'Aristotle liked dogs' as predicated of something and not just concatenated to the name 'Aristotle' Clearly, this needs to be objective predication, a relation that holds of predicables and topics independently of what particular things we happen to judge

Expand your notion of predicables from predicates, understood as subsentential expressions, to properties, and the more general notion of objective predication will serve to solve the problem of the unity of the proposition, even as it might arise for languages whose sentences do not have merely first-order logical forms, languages that are not easily provided with a Tarskian definition of truth in terms of satisfaction

Given the forgoing, the notion of a principle of unity can be used to explicate, if not actually vindicate, a strong version of the idea of truth-making that is at the core of the correspondence theory of truth We have states, that is, wholes which have properties and sequences of items as parts, wholes whose principles of unity require that constituent property be instantiated by the constituent sequences And we have simple propositions, that is, wholes which have properties and sequences of items as parts, wholes whose principles of unity require that constituent property be predicated of the constituent sequences We can now say that the truthmaker for a proposition is the state which is the "instantiation variant" of the proposition This will be the whole that differs from the proposition in just this respect, whereas in the proposition the constituents are unified by predication, in the state the very same constituents are unified by instantiation[18] A proposition is true if there is a state that is its instantiation variant That is the base case Other propositions are made true by being entailed by those with instantiation variants So a proposition is true if it has an instantiation variant or is entailed by a proposition which does

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[18] That is how truth-making will go on a Russellian conception of propositions as having (sequences of) topics and predicables as constituents On a conception of propositions that replaces (sequences of) topics and predicables with modes of pre-

XV SHOULD WE CULL SETS OR CULL SUMS?

This overview of the usefulness of the notion of a principle of unity would not be complete without deploying it to put some pressure on those theorists who believe there are both sets and mereological sums

This rather common attitude may be no more than a pleasing symptom of the catholic approach to initial steps in ontology, the approach that was praised in section ii Nonetheless, as a position in fundamental ontology, it must strike the historian of philosophy as rather odd About eighty years ago, Stanisław Leśniewski introduced mereological sums in order to replace sets After all, the most natural theory of sets had turned out to be *logically* inconsistent, and there was no obvious way of *minimally* modifying the most natural theory so as to avoid just the sets whose existence is ruled out by logic alone Even more pertinent to the present discussion, Leśniewski was repelled by what he saw as an orgy of double counting in set theory, involving such distinctions as that between the set (a,b,c) and the set $(a, b, (c))$ [19] Mereology was to be the solution to both problems

One way to introduce Mereology is to start with the notion of a part and then introduce two definitions, thus

D1 x and y *overlap* just in case they have some common part

D2 An item is a *fusion* of some other items just in case it has all of them as parts and has no part that does not overlap with any of those items

The characteristic axioms of Mereology are then stated as follows

> That a part of a part of a mereological sum is also part of that sum
>
> That there is no restriction on the formation of mereological sums, that is, given any items there is some mereological sum that is their fusion
>
> That the mereological sums so formed are unique, that is, given any items there is just one mereological sum that is their fusion
>
> That every mereological sum is part of itself

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sentation of the same, we can first imagine the Russellian "shadow" of the proposition consisting of say the sequence of the presented topics and the presented predicables We will then say that the truthmaker for such a proposition is the instantiation variant of the sequence which is the Russellian shadow of the proposition

[19] For a presentation of Leśniewski's theory, see Henry S Leonard and Nelson Goodman, "The Calculus of Individuals and Its Uses," *Journal of Symbolic Logic*, v (1940) 45–55

We have already seen more than enough to forever resist the temptation to suppose that Mereology is the *general* theory of parts and wholes We know that wholes do not in general satisfy uniqueness, more than one whole can arise from the very same items by way of different principles of unity holding of those items The general theory of parts and wholes would be given in the full development of Hylomorphism, not in Mereology

As formulated however, the above postulates are meant to bring into view a particular kind of whole, the mereological sum The question arises as to what the principle of unity of a sum is

One thing is certain, sums lack distinguished principles of unity If *S*, the sum of *a* and *b*, is summed with *S*′, the sum of *c* and *d*, then of the resultant sum *S** it is equally correct to say

What it is for *S** to exist is for *S* and *S*′ to exist

What it is for *S** to exist is for *S*, *c*, and *d* to exist

What it is for *S** to exist is for *a*, *b*, and *S* to exist

And so on, for any divisions of *a*, *b*, *c*, and *d* For any principle of division of the sum, we have something that corresponds to a principle of unity for the sum A sum, unlike a set of sets, or almost every other kind of item, has no articulated structure, at least none that does not derive from the individual structures of the items that are its parts (And here is another route to the conclusion that dinner parties, molecules, stars, organisms, word-tokens, and so on and so forth, are not sums They all have a natural structure of distinguished genuine parts determined by demanding principles of unity Notice that this is a consideration distinct from that involving the modal differences between these items and the corresponding sums It also means that much of contemporary ontology is disabled by a much too simple conception of wholes This is so even if there are mereological sums, contrary to the indications noted below)

This bears on the ground of the principle of uniqueness of mereological summation, and on why uniqueness of composition fails once we allow other sorts of items It is because mereological sums have no articulated structure that there is no basis for distinction among *mereological sums* with just the same parts But, for other kinds of items, a structure-inducing principle of unity can be such a basis

Here is a plausible principle of unity for mereological sums, one which explains their utter lack of structure All a sum requires of its parts is that they all exist That is why the sum of my molecules is no better and no worse a sum than the sum of the Eiffel Tower and my left foot All of these summands are on a par, in that they exist All the fiat parts of the sum are on a par, in that they exist There is no basis in the principle of unity of a sum for the distinction between genuine and fiat parts So there is no such distinction between the parts of a sum Assigning sums that uniform principle of unity explains why there cannot be two mereological sums with the same parts Every sum requires only existence of its parts, so if one sum has the same parts as another sum, then "they" will be the very same sum, because "they" have the same parts and principle of unity

The sum is thus a sort of null whole, the limiting case of a whole, a whole with the least demanding principle of unity, namely just that its elements exist There is no reason why a Hylomorphist should doubt that there are such null wholes

Yet when we bring Hylomorphism to bear on *sets*, we discover an interesting tension What is the principle of unity of the singleton of Socrates? What property must hold of Socrates for the singleton of Socrates to exist? Obviously, all that is required is for the singleton of Socrates to exist is for Socrates to exist Similarly for the pair set of Socrates and Plato, all that is required for this pair set to exist is for Socrates to exist and Plato to exist Similarly for all of what we might call the "flat sets," those sets whose members do not include sets The principle of unity for the flat sets is simply the existence of their members So much seems obvious once we treat sets as wholes whose parts are their members But why should we do that?

The hypothesis that in general sets are wholes, with their members as parts, and whose principle of unity is just the existence of the members, serves to explain the criterion of individuation for sets That criterion is captured by the Axiom of Extensionality which has it that sets are identical if and if only if they have the same members From left to right, we have an instance of the general principle that wholes are identical only if they have the same parts From right to left, we can reason in the following way Suppose sets x and y have the same members and thus the same parts, then x and y will be distinct items only if they have distinct principles of unity But the principle of unity for sets in general is the existence of their members So x and y are identical if they have the same members We thus derive the Axiom of Extensionality from the account of what it is to be a set[20]

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[20] In *Parts of Classes* (Cambridge Blackwell, 1990) David Lewis offers us a quite different conception of the constituents of a set He takes them to be the subsets of the set! Think, he says, of a set as a mereological sum of the singletons of its members Then a set will be identical to the sum of the members of its power set But, as Lewis notes, we need to take the relation between an item and its singleton as a nonmereological relation Of course, from the point of view of the present paper, that is a non-

This is just what we should expect in the more general case, the criterion of individuation for members of a kind of complex whole should be accounted for by the essence of the complex whole. That is, the criterion of individuation for items of a given kind of complex whole should be derivable from the account of what it is to be an item of that kind, an account which invokes the parts, origins, and principles that are characteristic of items of the kind in question. In the case of sets, the relevant derivation (which need not invoke origins) is what vindicates conceiving of the members of sets as parts of the sets.

Given that the principle of unity for sets is the existence of their members, it may now seem that Leśniewski was right to see in set theory an orgy of double counting. Focus on the structured sets, the sets with sets as members, for example, the pair set of Socrates and the singleton of Plato (Socrates, (Plato)). What is the principle of unity of the structured sets? If the set is not a gerrymandered kind, utterly unfit to be a category, then the flat sets and the structured sets should have the same principle of unity. So what it is for the pair consisting of Socrates and the singleton of Plato to be? Surely it is for Socrates to be and the singleton of Plato to be. Now, what is it for the singleton of Plato to be? Surely it is for Plato to be. Let us now put together these last two claims. What it is for the pair consisting of Socrates and the singleton of Plato to be is for Socrates to be and for Plato to be.

The problem is obvious, that account of what it is for the pair consisting of Socrates and the singleton of Plato (Socrates, (Plato)) to be is identical to the account of what it is for the pair consisting of Socrates and Plato (Socrates, Plato) to be. Yet set theory tells that these two sets are distinct.

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mereological relation of part to whole. Socrates stands in the same relation to {Socrates} as he does to {Socrates, Plato}, namely membership, and membership is a nonmereological relation. For it allows for iterative structure.

Lewis's appeal to a set's subsets, rather than its members, as the parts of the set, seems to flout the order of explanatory dependence. Surely, we explain the truth that sets x and y have the same subsets if and only if $x = y$ by the more fundamental truth that sets x and y have the same members if and only if $x = y$. We simply appeal to the standard definition of subsets. The more fundamental truth about members and identity is explained in terms of the parts and principle of a set. Lewis's less fundamental truth about subsets and identity is an explanatory epiphenomenon when it comes to the parts of sets.

From the point of view presented here, *Parts of Classes*, like so much of Lewis's work, takes the oddest kind of whole, the mereological sum, to be the only kind of whole, and hence as the only model for thinking of sets as wholes. Why should not sets exhibit their own distinctive kind of whole?

This is one way of reconstructing the feeling that there is an orgy of double counting in set theory

What has gone wrong? Certainly there can be nothing wrong with the mathematical practice of set theory, understood as the exploration of an abstract structure with certain features And indeed, there does seem to be a class of items where the distinctions due to iterative structure are real distinctions This is the case with groups (in the ordinary, not the mathematical, sense) Go back to the case of unions, and suppose then that the constitution of the ACTU is as follows

<Dock Workers' Union, Fitters and Turners' Union>

For all that has been said, the Fitters and Turners' Union could be a higher-order union consisting of the Fitters' Union and the Turners' Union On that assumption we could depict the above constitution of the ACTU as follows

<Dock Workers' Union, <Fitters' Union, Turners' Union>>

But now suppose that the Dock Workers' Union, the Fitters' Union, and the Turners' Union are deeply unhappy with the ACTU Still the hierarchy of the Fitters and Turners' Union is on good terms with the hierarchy of The ACTU So the three unions, the Dock Workers' Union, the Fitters' Union, and the Turners' Union form a new group, the Australian Organization of Trade Unions, the AOTU The Fitters and Turners' Union refuses to join the AOTU

(Do not say that this is just a philosopher's example, union politics is actually much more Byzantine)

We have then the following consistent situation, where the bracketing indicates a group

The ACTU = <Dock Workers' Union, <Fitters' Union, Turners' Union>>

The AOTU = <Dock Workers' Union, Fitters' Union, Turners' Union>

The Fitters and Turners' Union = <Fitters' Union, Turners' Union>

Obviously, distinguishing the ACTU and the AOTU in this way is not double counting They have different members, for example the Fitters and Turners' Union is a member of the ACTU and not the AOTU This is entirely compatible with the Fitters and Turners' Union being a group consisting just of the Fitters' Union and the Turners' Union

The example illustrates how the structure of groups allows for what would otherwise be double counting Although

The Fitters and Turners' Union = <Fitters' Union, Turners' Union>

what it is for the Fitters and Turners' Union to exist is *not* just for the Fitters' Union to exist and for the Turners' Union to exist. The two unions have to be in an appropriate association. This is a more demanding principle of unity than mere existence, the principle required for the two unions to form a set of which they are members.

Those reflections suggest the following thesis, the accusation that set theory involves an orgy of double counting fails, once we understand the structure of sets as if it were abstracted from the structure of groups, where groups have relatively demanding principles of unity.

On this defensive line of thought the set, understood as a *philosophical* category, that is, a fundamental kind apt to be appealed to in philosophical explanations, is still under some tension. The mathematical enterprise of set theory is concerned with a structure that is found in (ordinary) groups, thanks to their demanding principles of unity. But in focusing on that structure, it has abstracted away from the substantial principles of unity that made that structure possible. This is shown by the utterly undemanding unity condition for sets. Although it is full of mathematical interest, set theory is neither the general theory of groups in the ordinary sense, nor the simple theory of those items that exist just when their constituents do, namely the mereological sums. The category of the set combines the flat and undemanding principle of unity of sums, the mere existence of the elements, with the articulated structure that comes with the substantial principle of unity of groups. If this is so, then the putative category of the set is too gerrymandered a kind to count as a real category.

So the defensive line of thought treats sets as what we might call "phantom" wholes, sets mimic the structure of groups without having the substantial principles of unity that make that structure possible. The defensive line of thought does not threaten the mathematical interest of set theory. But it does imply that as philosophers we should not place too much explanatory weight on the category of set. What remain are the categories of the sum and the group.

XVI SAVING IMPURE SETS AT THE EXPENSE OF SUMS

I believe we can do better than this defensive line of thought. Its verdict against the impure sets may be turned around, to the discredit of sums. The leading idea is that if there is some whole whose principle of unity is just the existence of its members or elements then it will be natural to identify such a whole with a certain state or condition of its members or elements, namely their existence. So both impure sets and sums cry out to be identified with the existence of their elements But the existence of something is quite generally not identical with the thing in question Once we see that, the "flatness" of sums, their lack of iterative structure, looks at odds with their principle of unity

To begin to illustrate the idea, let us first fix on a particular view of existence We might suppose existence is a "first-order" property, properly expressed in English not by the particular quantifier 'some' but by the predicate 'exists' One reason for thinking that existential import is not carried simply by the semantics of the particular quantifier is to be found in the *logical* coherence of certain statements or thoughts, which would be logically incoherent if the particular quantifier invariably carried existential import as a purely semantic matter So an ontologist might theorize that there are generative processes which can reach a very late stage, a stage at which there is a definite individual who would come into being if the process were allowed to continue As it happens, some of these processes have been aborted at some such late stage As a result, so the ontologist supposes, there are some individuals which have been prevented from existing This entails that there are some individuals that do not exist

The thought that there are some individuals that do not exist may be false, and necessarily so But is it *logically* incoherent, false just in virtue of its logical structure? It seems not, and the cost of recognizing that is to decouple existential import from the particular quantifier There is then room for existence as a significant first-order property

When you have properties and items they hold of then you have states or conditions If *F*-ness holds of *a* then we can then speak of the *F*-ness of *a* And we might countenance this state or condition of *a* as a further item distinct from *a* (Since it is not a material object, but a state, we might think of it as having *F*-ness and *a* as parts) So if existence is a property and *a* exists then we might countenance an item which is *the existence of a* And so also for *a* and *b*, if they exist then we might countenance an item which is *the existence of a and b* The first item would bid fair to be the singleton of *a*, for it is an item whose existence requires no more than that *a* exists The second item would likewise bid fair to be the pair set of *a* and *b* The operator "the existence of" is thus to be understood as expressing a variably polyadic relation which holds of *a*, *b*, *c* when they all exist

Here we have a way to generate impure sets just on the assumption that their principle of unity is that their members all exist Associated with this relation is an item-generating function which takes us from any existent items to a set of those items understood as the existence of those items

Well, why is it the impure *sets* that are generated, rather than the corresponding sums? It all depends on whether we take the function associated with the operator 'the existence of' to iterate significantly, so that

> The existence of the existence of *a,b,c* is a distinct item from the existence of *a, b, c*

If so, we can produce a hierarchy of impure sets by the iteration of this function

Once we think of the function as item-generating, that is, taking you from *a* to another item which is the existence of *a*, then it is very natural to think of the function as iterating significantly, so that it takes you from the item that is the existence of any given item to another item which is the existence of the given item So the existence of the existence of *a* is distinct from the existence of *a* It seems then that we can recover a hierarchy of impure sets by allowing iterations of this item-generating function Conceived of in this way, the impure sets look like they form a real kind, for they have a uniform principle of unity[21]

Impure sets are here being represented as "existential states" of their members Given this representation, the members of the sets are parts of the set, but so also is the property of existing which is the principle of unity of its members

Just to be clear about the scope of the present point, we are not here trying to offer a philosophical reconstruction of a particular mathematical theory of sets, but only to bring into clear view the idea of a whole that has two defining features, namely

(a) Its principle of unity is the existence of its members

(b) It allows for internal structure in the way that a sum does not

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[21] The reader will have noted that I have said nothing of the null set On the (logically inconsistent) view that sets just are the extensions of predicates taken as wholes, the null set is no more problematic than a predicate that is satisfied by nothing at all On successor notions of the set, such as that embodied in the hierarchy of ZF, the empty set looks like a mathematically harmless limiting case where we are treating having zero members as a way of having members One notion of the null set that is consistent with the present discussion is the conception of the null set as the singleton of an arbitrary item, an item that is no item in particular So there is no particular item which is member of the null set Pure set theory then looks like an abstraction from all details concerning the nonsets that might be members of sets

There are a number of tenable views of arbitrary items On one view, an arbitrary item is an arbitrarily chosen item spoken of under a conspiracy of silence as to which item it is For a different conception, see Fine's *Reasoning with Arbitrary Objects* (New York Oxford, 1983)

The point is that the second is naturally seen as a consequence of the first, once we understand the first as encouraging the identification of the whole with the existence of its members [22]

As this point suggests, the sums will now seem most puzzling As with the impure sets, their existence requires only the existence of their parts or elements So, just as we found reason to identify the set of *a* and *b* with the existence of *a* and *b*, we have reason to identify the sum of *a* and *b* with the existence of *a* and *b* But then, since the function in question significantly iterates, there should be another sum corresponding to the existence of the existence of *a* and *b* This latter sum would be a sum which had only *a*, *b*, and perhaps existence as summands, but was distinct from the sum of *a*, *b*, and existence And it is axiomatic that there is no such sum [23]

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[22] One way in which the identification of impure sets with the existence of their members differs from the notion of a set implied by some mathematically useful set theories is that the identification seems to make no room for self-membered sets

[23] Here is an option for the mereologist Follow Judith Jarvis Thomson and distinguish what she calls "all-sums" and "some-sums", where the first exist only when all their parts exist, while the second exist when at least one of their parts exist See Thomson's "The Statue and the Clay," *Noûs*, xxxii (1998) 149–73, and also Fine's "Compounds and Aggregates," *Noûs*, xxviii (1994) 137–58, where compounds are very like all-sums and aggregates like some-sums I believe that in most philosophical applications of mereology, it has been some-sums which were in play So the four-dimensionalist supposes that I am a some-sum of temporal parts

Impure sets, it might be said, compete with all-sums in respect of parts and principles, but do not compete with some-sums For an impure set exists at *t* only if all its members exist at *t* So we can distinguish some-sums and impure sets, and allow for both

That thought does not survive the argument in the main body of the text The proposed principle of unity for some-sums is this the *xs* exist at some time or other, where the *xs* are the relevant summands There is then a state of the *xs* which is their existing at some time or other And there is another state of that state existing at sometime or other (presumably this state exists at any of the times at which one of the *xs* exist) So once again, on the proposed principle of unity for some-sums, there ought to be two sums with the very same summands But it is axiomatic that there are not such sums

Hence the argument in the main body of the text goes through even if sets are all-sets and sums are some-sums

Another remark about sum-sums and all-sums is worth making Consider the happy period when Plato and Socrates both existed If we believe in some-sums *and* all-sums, then we should admit that during that period there were two sums with Plato and Socrates as summands, sums distinguished by their distinct principles of unity To accommodate this, we could contemplate a natural restriction on the axiom that distinct sums have distinct summands, namely that this is true only if they are both all-sums or both some-sums

Once we see that, a similar view of impure set theory might seem plausible So there is room to recognize some-sets as well as all-sets But then each some-set will have the same parts and principle of unity as a some-sum, and each all-sum will have the same parts and principle of unity as an all-set The sets will again "drive out" the sums

Notice that this same defense of sets over sums may be mounted by those who take one of the standard (though I think, strained) views of existence These are that existence is either the second-order property of being of being an instance of some first-order property, or the second-order property of being a satisfier of some first-order predicate Even on such views, an item's existence can be seen to be a (relational) state of the item What it is to be that state is distinct from what it is to be the item So, here too, we can provide different principles of unity for an item, and its singleton, identified as the existence of the item

Where then did the Leśniewski-like argument that (Socrates, (Plato)) must be the same as (Socrates, Plato) go wrong? It was precisely at the step that held that what it is for the singleton of Plato to be is the same as what it is for Plato to be It is trivially true that for Plato to be is necessarily sufficient for Plato to be And, of course, for Plato to be is necessarily sufficient for the singleton of Plato to be But the essentialist's question of what it is for something to be is more fine-grained than what is captured by these remarks about necessity What it is for some set to be is always distinct from what it is for some individual to be, even if they necessarily have the same modal conditions of existence And this comes out more vividly when we identify the singleton of Plato with Plato's existence That state of Plato clearly has a different essence from Plato Existence is not part of his essence, but it is part of the essence of the state that is the existence of Plato[24]

XVII THE INVIDIOUS ONTOLOGICAL DISTINCTION REVISITED

Thus far, we have deployed Hylomorphism to put pressure on the idea that sets, sums, propositions, states, and facts should all be countenanced in a fundamental ontology The resultant culling left us with sets, propositions and states This was not the result of an arbitrary preference for "desert landscapes " We have simply taken on the full responsibilities of the thought that sets, sums, propositions, states, and facts would be certain kinds of complexes

In the light of all this, what are we to make of what we called the invidious ontological distinction, the apparent fact that some relations and not others are suited to be principles of unity?

Consider a piece of ice The piece of ice presents itself as a whole, here, as with material objects in general, it parts and principle are to be discovered *a posteriori*, but we may suppose that they involve hydrogen and oxygen being bonded together in a certain way However, that it itself will not specify the *what it is to be* of the piece of ice. The principle of unity of the piece of ice is in a certain way *maximal*, the piece of ice is the unit which you get by including *all* the connected hydrogen and oxygen that is bonded in a certain way. That is how the piece of ice differs from each of the three dimensional items which it is possible to demarcate within it, even those three-dimensional items which are large enough to include cases of one oxygen ion and two hydrogen ions appropriately bonded together.

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[24] Of course, it does not follow that this state necessarily exists It exists only if Plato does

What of those items? Are they wholes? Well, many of them will be small physical systems, maintaining themselves thanks to their extant structure of bonding. The fact that they are packed in with other physical systems of similar sorts does not undermine this status. So they are wholes, even though none of them are maximal structures of bonded units. That defect in respect of maximality is just how they differ from *pieces* of ice. They are no less genuine wholes than the piece of ice, but thanks our scheme of concepts they do not count as pieces of ice, or as genuine parts of the piece of ice. (How many pieces of ice do you have? Just one piece. How many parts does it have? No, no, it is not articulated or broken up at all. It is one solid block of ice.)

But now consider bonding. That is a highly determinable relation which involves attractive forces of various strengths, depending on the most determinate type of bonding in play. There does not seem to be any happy way to allow that bonding makes for wholes, while other attractive forces do not. (A point made by van Inwagen, and by Fine.) Gravity, of course, is a universal attractive force. Consider then all the myriad ways of constructing putative wholes from items gravitationally related to other items. Are they all genuine wholes? Given Hylomorphism, there does not seem to be any happy way to insist that they are not all *wholes*, even though very few of them will be material objects or stable physical systems. That may not make them genuine wholes in the ordinary sense, for the ordinary notion of a genuine whole has things like material objects, living things and artifacts as its paradigms. A whole consisting of your eyeglasses and Pluto is too far from these paradigms in respect of compactness and maximality to count as a genuine whole in the ordinary sense. But it is fully, completely and *genuinely* true that it is a whole.

We saw that Hylomorphism could allow for impure sets, wholes which place the least demands on their constituents, requiring only that the constituents exist. We are now allowing that the holding of any attractive force to any degree can be a principle of unity, that is, can give rise to a whole. Given those two concessions, it seems that the only nongerrymandered position in the domain is one that embraces a full plurality of principles of unity, which allows that the holding of any relation or property of some items makes for a whole Of course, from the point of view of our conceptual scheme, the enormous majority of such wholes will be idle items, beneath or beyond our habits of thought and reference

The view that emerges is not the Projectivist view to the effect that we have wrongly supposed that our scheme of bundling and clumping applies to reality What emerges is rather a highly selective "Detectivist" view which has it that our scheme of clumping and bundling sensitizes us to a very small selection of the enormous variety of wholes that are genuinely there And Hylomorphism helps explain how this goes, we are sensitized to those physical systems which are relatively compact, and have self-maintaining principles of unity which hold maximally within their compact structure (So we are sensitive to the piece of ice, but not to the small spherical unit around its center) Among these compact material wholes whose self-maintaining principles of unity are maximal within their compact structure are the material objects, artifacts, and living things—the pivot points of our scheme of reference and thought

So much, then, for the invidious ontological distinction We can now see how that distinction was the product of an illusion of salience The material wholes that strike us as paradigmatically genuine are compact, well-articulated items that have self-maintaining principles of unity, items like Aristotle's favorite examples of substances, "the individual man and horse " But the least arbitrary form of the general theory of unity that is Hylomorphism tells us that besides these "genuine" wholes there is a vast plurality of wholes that ordinarily escape our attention

To see things aright requires that we take Hylomorphism to be the general theory of wholes, while at the same time cashiering the natural, Aristotelian idea that all true material wholes must be compact, well-articulated, and self-maintaining

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IN DEFENSE OF THREE-DIMENSIONALISM*

Let us use the term 'present' in such a way that a material thing can be said to be present both in space and in time Thus on this usage we can say that the desk in front of me is present at any moment at which it exists and also that it is present at any position within its spatial location at that moment We might similarly talk of presence throughout a *period* of time or a *region* of space and of the presence of other categories of objects, such as states or events

Some philosophers, the "three-dimensionalists," have thought that there is a distinctive way in which material things are present in time as opposed to space They have thought that a thing is somehow "stretched out" through its location at a given time though not through the period of during which it exists and that it is somehow present in its entirety at any moment at which it exists though not at any position at which it is located Other philosophers, the "four-dimensionalists," have denied that this was so, they have thought that a material thing is as equally "stretched out" in time as it is in space and that there is no special way in which it is entirely present at a moment rather than at a position

We might use the term 'existence' for the way in which 3D-ers have thought that a thing is present in time and 'extension' or 'location' for the way in which 4D-ers have thought that a thing is present in space The 3D-ers have then held that things exist in time but are extended in space while the 4D-ers hold that things are extended both in space and in time [1]

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* Much of the work for this paper was done around fifteen years ago in preparation for an as yet unpublished book on the metaphysics of material things Some of the work was recently presented in a seminar at New York University, a metaphysics workshop at Glasgow University, a talk at the University of Aberdeen, and a conference on Being at the University of Leeds I should like to thank the participants at those meetings for much helpful discussion, and I am especially grateful to Ruth Chang and Peter Simons for their detailed comments

[1] My terms 'presence', 'existence', and 'extension' (deriving from my paper, "Compounds and Aggregates," *Noûs*, xxviii, 2 (1994) 137–58)) correspond to the more familiar terminology of 'persistence', 'endurance', and 'perdurance' I prefer my own terminology since it is somewhat more general, allowing one to talk of existence or extension at a moment when one cannot very well talk of endurance or perdurance at a moment and allowing one to talk of existence or extension in space when one cannot very well talk of endurance or perdurance in space

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But how is the distinction between existence and extension to be more precisely understood? It has been common, for 3D-ers and 4D-ers alike, to explain the distinction in mereological terms.[2] For a thing to be *extended* in time, that is, to be present in the distinctively 4D way, is for it to be composed of momentary temporal parts—parts which exist only for a moment and which together make up the thing, and for a thing to *exist* in time, that is, to be present in the distinctively 3D way, is for it to lack momentary temporal parts or perhaps temporal parts at all. Thus on this understanding, the issue between the 3D-ers and 4D-ers is over whether or not the presence of the thing in time requires the presence of its temporal parts.

A major difficulty with this way of understanding of the issue (not the only one!) is that there are a variety of reasons, apart from being a 3- or 4D-er, why one might wish to reject or to affirm the existence of momentary temporal parts. Thus even if one is a 4D-er one might reject the existence of momentary temporal parts on the grounds that nothing momentary exists and even if one is a 3D-er one might affirm the existence of momentary temporal parts on the grounds that everything merely endures for an instant. It would be going too far to say that the issue between the 3D-er and 4D-er has nothing to do with the existence of temporal parts. But the issue over the existence of temporal parts is best seen as a symptom of an underlying dispute, one that arises once certain ancillary assumptions are accepted, and not itself the source of the dispute.[3]

In the light of such difficulties, one might attempt to refine the mereological criterion for distinguishing between the two kinds of presence or to find some other basis upon which they might be distinguished. But this whole approach to explaining the issue strikes me as misguided. For it presupposes that there is a unitary notion of generic presence to which both sides of the dispute can adhere. Given that there is such a notion, the question is then to find some way in which the more specific forms of presence might be differentiated.

However, the 3D-er, in my opinion, is better regarded as endorsing two *radically different* forms of presence—one relating to how an object exists and the other relating to how it is, or "disposes of itself," once it exists. These two forms of presence are not to be understood as *restrictions* on a more generic form of presence but as independent forms of presence in their own right. Thus rather than thinking of presence as a uniform phenomenon that stands in need of differentiation into distinct species or kinds, it is to be regarded as an essentially disjunctive phenomenon that must itself be understood in terms of the more specific kinds.[4]

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[2] As, for example, in Theodore Sider, *Four Dimensionalism* (New York: Oxford, 2001).

[3] The difficulties with the mereological formulation and the connection between the various formulations will be further discussed in a forthcoming paper, "The 3D/4D Debate."

On the usual way of understanding the 3D/4D dispute, there will be agreement on the distinction between existence and extension, whether explained in mereological or in other terms, and the question at issue will be over its application. Do material things belong to the one side of the divide or to the other? But on the present view, there is a more fundamental dispute over the nature of the distinction itself, quite apart from how it is to be applied. For where the 4D-er sees existence and extension as two species of a generic form of presence, the 3D-er will see them as independent forms of presence in their own right.

Given the 3D-er's understanding of the distinction, he is likely to resist the demand to explain it in basically different terms. For if the two forms of presence are not to be explained as differentiations of a more generic form of presence, then it is unclear how a more basic understanding of either of them is to be achieved. Perhaps the best that can be done to elucidate the distinction is by way of the idea of "entire" or "complete" presence. When an object extends, or is located at, a given place, then it may either be located *in its entirety* or *in part* at that place. A chair, for example, will be located in its entirety at the region occupied by the chair but will only be located in part at the region occupied by the back of the chair. However, this is not how it is for existence. The point is usually put by saying that, for the 3D-er, a thing will exist, or be present, in its entirety at a given time. But this is somewhat misleading—for it suggests that 3D presence is simply the restriction of a more generic form of presence to those cases that are entire. The better way to make the point is that, whereas we can meaningfully distinguish between an object's being located in its entirety or in part at a given place, we cannot meaningfully distinguish in the analogous way between an object's existing in its entirety or in part at a given time. Location may be a matter of more or less but existence is not.

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[4] Some authors have recently attempted to frame the 3D/4D dispute in locational rather than mereological terms, but by appeal to the notion of exact occupancy rather that the distinction between existence and extension (see, for example, pp. 103–04 of John Hawthorne, *Metaphysical Essays* (New York: Oxford, 2006)). However, it seems to me that the distinction is more basic and that *exact occupancy* is to be understood in terms of the distinction rather than the other way round.

The 4D-er is unlikely to be moved by these explanations. For him, an object simply *resides* in the space-time continuum and it is not as if there were two facets to its presence in the world, one relating to its status as an existent in time and the other to its status as an occupant in space. To these philosophers, the 3D-er's assumption of a basic distinction between existence and extension will appear as an act of desperation, simply arising from his inability to explain the distinction in more satisfactory terms. However, I believe that such a response is unwarranted and that there are a number of considerations which strongly suggest that the distinction is to be understood and applied in just the way the 3D-er thinks. Some of these considerations concern our use of locative expressions in ordinary language, some our conception of composite objects, and some our conception of changing composition, and in each case, it is only the 3D-er's point of view that is able to provide a satisfactory account of the phenomena.

We should note, in the first place, that the distinction between existence and extension, as the 3D-er understands it, is already deeply embedded in our ordinary way of speaking. Let me provide a few of illustrations of this, although there is an enormous amount of related linguistic evidence that might also be given. We begin with the locative use of 'is'. I may ask 'Where is Peter?' and 'Where is the party?' I may also ask 'When is the party?' But I cannot properly ask 'When is Peter?' Thus the locative use of 'is' is subject to the following pattern of distribution:

	Things	Events
Time	X	√
Space	√	√

with things and events standing in the 'is'-relation to space but with events, though not things, standing in the 'is'-relation to time. Thus the locative use of 'is' behaves in exactly the same way as the 3D-er's notion of extension and it is hard to avoid the impression that the one is simply the ordinary language expression for the other.

Of course, the 4D-er might argue that the locative use of 'is' embodies an implicit restriction of the generic notion of presence to the presence of things in space or to the presence of events in space or time. But such a view is not at all plausible. For 'is' is a relatively neutral term (unlike 'continues', say, or 'occurs') and there is nothing in our understanding of the term to suggest that its application might be restricted in regard to either category (thing versus event) or dimension (space versus time). The term would appear to be ideally suited to express the underlying locative relation of the 4D-er, and it is remarkable that it fails to signify the relation and that there is no other word or simple nondisjunctive phrase by which it might be expressed

Similar remarks apply to the ordinary "locative" use of 'exists' I have so far used 'exists' in a technical sense to indicate a certain manner of presence but I think it corresponds pretty well to our ordinary use of the term We may ask 'When did Plato exist?' But we cannot properly ask 'Where did Plato exist?' or 'When did the party exist?' or 'Where did the party exist?'[5] Thus the ordinary use of 'exists' has a complementary distribution to that of 'is'

	Things	Events
Time	√	X
Space	X	X

with things having existence in time but not in space and with events lacking existence either in time or in space Thus the ordinary use of 'exists' exactly corresponds to the philosophical use and, again, it is hard to avoid the impression that the one is simply a term for the other

Of course, the 4D-er might argue that the ordinary term 'exists' embodies an implicit restriction of the generic notion of presence to the presence of things in time But 'exists', like 'is', is a relatively neutral term and it seems even less plausible than before that it might embody such a strong restriction We should also note that 'exists' has a use that is not relative to a time or place (as in 'God does not exist' or 'There exist prime numbers between 8 and 15') The relative and nonrelative uses of 'exists' would appear to be cognates, and so, from the 4D-er's point of view, it is quite bizarre that a term with a nonrelative nonlocative use should also enjoy a relative locative use

The linguistic evidence is not confined to locative expressions such as 'is' or 'exists' One further example—concerning 'motion'—may be mentioned A billiard ball may be in motion but the movement of the billiard ball is not thereby in motion Whence the difference? After all, both the billiard ball and its movement undergo a change in position Each is located at a certain position at the beginning and at the end of the movement and each changes its position continuously from one moment to the next

The 3D-er may explain the difference by appeal to the general distinction between existence and extension Motion involves a change in position But not any change will do In order to have genuine motion rather than mere variation in position, it is necessary that the object should be "entirely present" at each moment of the change Thus without entire presence, or existence, genuine motion will not be possible

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[5] One can perhaps say that Plato existed in Athens but it is a more episodic use of the term that is here in question and, on this use, one cannot sensibly say 'Plato exists (right now) in the Academy'

No such explanation is available to the 4D-er For him, the underlying phenomenon in the case of the billiard ball and its movement is the same—there is simply a variation in location from one moment to the next Thus all that could possibly justify our speaking of 'motion' in the one case rather than the other is that our application of the term has a built-in restriction to things But it is then a mystery why such arbitrary restrictions should be in force or why our language does not provide a more general vocabulary for describing the underlying phenomenon

The 4D-er claims not to understand the 3D-er's distinction between existence and extension But in the light of the linguistic evidence cited above, it is the 4D-er's insistence on a single generic form of presence that is baffling rather than the 3D-er's insistence on a distinction For the 4D-er's notion has no basis in our ordinary way of talking about the presence of objects in space and time It would appear to arise simply from a preconceived picture of how things must be rather than from an especially acute sense of how things are He refashions the conceptual landscape in the light of his own metaphysical views and then expresses astonishment when others claim to see what, from his own vantage point, is not there to be found

Not only is the distinction between existence and extension deeply embedded in our ordinary way of speaking, it would also appear to be deeply explanatory of our ordinary ways of thinking about part-whole This is true both of our thinking about relative parthood, that holds relative to a time or place, and of our thinking about absolute parthood, that is not relative in this way

We begin with the case of absolute part Consider a given quart of milk It is composed, in an absolute or timeless sense, of two pints—one at the bottom of the jug, say, and the other at the top [6] Let us now ask When does the quart of milk exist (or, to put it neutrally, when is it *present* in time—nothing turns on my use of the term 'exists')? Presumably the answer is when and only when both of the two pints of milk are present If one of the pints were to cease to exist, then the quart would cease to exist, and, conversely, as long as the pints still exist then the quart will still exist Given that the quart of milk exists at a given moment, let us now ask Where is it at that moment?

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[6] I am taking the quart of a mile to be a *quantity* whose immediate material composition cannot change from one moment to the next This kind of case and some of its implications are further discussed in my paper, "Compounds and Aggregates "

Presumably, where and only where the two pints are. For surely it is where they are and not anywhere else.

We see that the period of time during which the composite milk—the quart—exists is the *intersection* of the periods of time during which the individual pints exist and that, at any moment at which the composite milk exists, its location is the *union* of the locations of the pints. We may state the matter in terms of presence at a moment or at a position, where an object is said to be present at a position if its total location includes the position (all relative to a given time, of course). Supposing the quart of milk q to be the composite or sum $p_1 + p_2$ of the two pints p_1 and p_2, the quart q will then be present at a moment of time iff both p_1 and p_2 are present at that moment and, given that q is present at a particular moment, it will, at that moment, be present at a position in space iff either p_1 is then present at that position or p_2 is then present at that position. Thus a composite thing will conform to conjunctive conditions of presence with respect to time (corresponding to the intersection of the periods of existence) and to disjunctive conditions of presence with respect to space (corresponding to the union of the regions of location).

Consider now a composite event. Suppose that there is some lightning that is composed of two individual streaks of lightning. When does the lightning occur? Presumably when and only when either one of the individual streaks of lightning occurs. It begins with the one streak of lightning and ends with the other. Now given that the lightning occurs at a particular moment, where is it? Presumably, where and only where either one of the individual streaks of lightning is at that moment. For surely it is where they are and nowhere else.

We see that the period of time during which the composite lightning occurs is the union of the periods of time during which the streaks of lightning occur and likewise, at any moment at which the composite lightning occurs, its location is the union of the locations of the streaks. Or to state the matter in terms of relative presence, the lightning l, which we may take to the composite or sum $s_1 + s_2$ of the two streaks s_1 and s_2, will be present at a moment of time if either s_1 or s_2 are present at that moment and, given that l is present at a particular moment, it will, at that moment, be present at a position of space iff either s_1 is then present at that position or s_2 is then present at that position. Thus the lightning submits to disjunctive conditions of presence with respect to both space and time.

What explains the disparity in the conditions of presence? Why should the composite thing, the quart of milk, submit to different conditions of presence from the composite event, the lightning? And why should the conditions of presence for the composite thing be different for time than they are for space?

The 3D-er has a ready explanation He will hold that things are present in space and time in a way that is different for events A thing will exist in time and be extended in space, while an event will be extended both in space and in time The 3D-er will also hold that objects sum differently with respect to existence and extension Supposing two objects to exist at a given moment of time, their sum will exist at that moment if and only if both objects exist at that moment But supposing two objects to be extended in space at a given moment of time, their sum will, at that moment, be located at a position in space if and only if one of the objects is then located at that position in space, and similarly for when an object is extended in time The difference in the presence conditions for the sums of things and events then immediately follows For given that things exist in time and are extended in space, sums of things will acquire the conjunctive conditions appropriate to existence in time and the disjunctive conditions appropriate to extension in space, and, given that events are extended in both space and time, sums of events will acquire the disjunctive conditions appropriate to extension in space and time

This explanation rests upon two assumptions The first is that there is a difference in the way things and events are present in space and time, with things having an existential presence in time and an extensional presence in space and with events having an extensional presence both in space and in time Once the distinction between existence and extension is granted, this difference in the existential and extensional profiles of things and events may reasonably be taken to be definitive of what it is for something to *be* a thing or to *be* an event Thus no further explanation of why things and events should have the profiles that they do may reasonably be required

The second assumption is that there is a difference in the conditions of presence for a sum in the cases of existence and extension, with the conditions being conjunctive for existence and disjunctive for extension In this case, it might be wondered why there should be this difference in the presence conditions Why should not both kinds of condition be disjunctive, for example, or both be conjunctive?

I am not sure it is possible to derive the two types of presence condition from more basic assumptions but it is possible to show how the difference between them naturally flows from our intuitive understanding of the difference between the two forms of presence For, as we have remarked, existence cannot meaningfully be qualified as partial or entire Suppose now that a sum of two objects could be said to exist at a moment when only one of those objects existed There would then be a clear sense in which the existence of the sum was partial—the object exists at the moment even though it is not entirely present at that moment Disjunctive conditions of existence—or anything short of conjunctive conditions—are therefore ruled out by our very understanding of what it is for something to exist Similarly, if extension can be partial, then there would appear to be nothing to prevent a sum of objects being present when or where only one of the objects is present

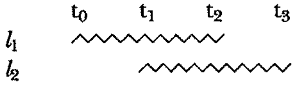
The 3D-er's account of these cases is strikingly confirmed by some other cases Suppose that some coffee is brewing on the stove, next to an open bottle of vanilla essence The aroma of coffee and vanilla intermingle to create a composite aroma of coffee and vanilla Supposing the composite aroma to be present at a certain moment of time, then where is it present? Presumably, where and only where the aromas of coffee and vanilla are both present For it is certainly present where both aromas are present and how could it be present where only the aroma of coffee or only the aroma of vanilla was present Similarly, we may ask *When* will the composite aroma be present? And presumably the answer is that it will be present when both individual aromas are present (and also, we might add, when there is a place at which both are present)

Thus composite aromas conform to conjunctive conditions of presence in space and time But why should this be? The 3D-er can provide the same line of explanation that he gave before For he will claim that that aromas, sounds, physical fields and the like are the kind of object to exist in space as well as time They enjoy an "entire" presence at any place at which they are present and not just at any time (indeed, we may actually speak of an aroma *existing* here or *existing* there) And given the existential profile of these objects, it will then follow that their sums conform to conjunctive conditions of presence in both space and time

It is hard if not impossible to see how the 4D-er might account for any of these facts Events, things, and "fields" are all present in space and time in the very same way for him, and so what basis is there for drawing a distinction in the conditions under which their sums will be present in space and time? The 4D-er might perhaps respond by arguing that objects can compose wholes in different ways and that some methods of composition are subject to disjunctive conditions of presence while others are subject to conjunctive conditions or to a combination of disjunctive and conjunctive conditions I had supposed that two pints of milk compose a quart in the same way that two streaks of lightning compose some lightning But he will suppose that two different methods of composition are here in play and that it is this that accounts for the difference in the conditions of presence

It is rather implausible to suppose that the objects compose differently For in both cases we appear to have what one might call a "mere" sum of the objects in question, something that might be indicated by the use of 'and' or by the plural Thus the quart of milk, we want to say, is simply the two pints (or this pint and that pint) and the lightning is simply the two streaks of lightning (or this lightning and that lightning)

But there are difficulties for this view even if we grant that there are different methods of composition For one would then expect to be able to compose events in the way we naturally compose things or to compose things in the way we naturally compose events But we do not find that this is so Consider again the lightning and suppose that the two individual streaks of lightning briefly overlap in time, as depicted below



Is there then some composite lightning, composed of the two individual streaks, that lasts from t_1 to t_2? Surely not There is indeed some simultaneous lightning that goes on during that period But it does not have each individual streak of lightning as a part but merely those parts of the individual streaks that occur between t_1 and t_2

It is the same when we consider whether things might compose in the manner of events For consider again the two pints of milk and suppose that, like the streaks of lightning, they briefly overlap in time Is there then some composite thing, composed of the two pints of milk, that lasts from t_0 to t_3? If there is such a thing, then it is certainly not the quart of milk and nor is it anything that we would normally take to exist Of course, the 4D-er will take it to be the fusion of the two pints of milk but it is only if one already accepts his position that one will find it plausible that there is such a thing!

The difficulties become even more acute when one asks whether things or events might sum in the same uniformly conjunctive manner as aromas Consider two siamese twins, joined at the hip Is there then a composite object, composed of the two twins, that is entirely located in the region occupied by the hip—some sort of "essence" of siamese twin? We seem unable to form any intelligible conception of what such an object might be

We turn finally to considerations of relative part I have so far talked of parts in an absolute sense of the term The quart of milk is composed in an absolute or atemporal sense of the two pints and the lightning of the two streaks of lightning, and so there is an absolute or atemporal sense in which the two pints are parts of the quart or in which the streaks of lightning are parts of the lightning But there is also a relative or temporary notion of part My car now has this tire as a part and later has another tire as a part, and this kidney, which was once a part of your body, is now a part of my body

The notion of temporary parthood has its natural home in talk of changing composition Objects may change their composition over time and the composition of an object, at any given time, is given by its parts at that time Thus for an object's composition to change from one moment to the next is for its temporary parts to be different from one moment to the next

As I already have observed, we are willing to talk about the changing composition of *things* The car, for example, will change its composition from one tire change to the next and my body from before and after a kidney transplant, and each of these things will change its composition in much less dramatic ways as well But we are also willing to talk of the changing composition of *events* The lightning, for example, will change its composition over time—consisting first of this streak of lightning, let us say, and later of this other streak, and the chiming of a door bell may consist first of this chime (an 'E') and then of that chime (a 'C') We may even talk of a change in the composition of a thing or event from one place to another Thus we might say that my body is composed here of bone and there of flesh or that the simultaneous lightning is composed here of this streak and there of that streak

Although we are willing to talk of changing composition in all of these cases, the sense in which the underlying notion of relative parthood is to be understood is very different in the case of things in time than in the other cases To say that the lightning is at a given time part of the storm is to say, first, that it is in an atemporal or nontime-relative sense a part of the storm and, second, that it occurs at the given time [7] Likewise, to say that this flesh is here a part of my body (at a given time) is to say, first, that it is in an aspatial or nonplace-relative sense a part of my body (at the time) and, second, that it is located here (at the time), and similarly for the place-relative parts of events

But the sense in which a tire is a temporary part of a car is not like this To say that a tire is a part of the car at a given time is not to say that it is a part in an atemporal sense and that it exists at the given time For the tire is not, in the relevant sense, an atemporal part of the car at all Whereas an event is a sum or composite of the various events that compose it at different times, a thing is not a sum or composite of the various things that compose it at different times The sum of the various parts—the tires, the spark plugs, the carburetors, and so on—that compose a car over its lifetime would be some kind of jumble rather than a car

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[7] This is most naturally taken to mean that it occurs *exactly* at the time or period of time in question, although there is an attenuated sense in which it might be taken to mean that it occurs *partially* at the time or period of time in question

Of course, there is a sense in which the tire *is* an atemporal part of the car For we may take one thing to be an atemporal part of another if it is, at some time, a temporary part of the other But this use of atemporal part is not what we are after For surely the tire may exist at a later time without then being a part of the car But under the proposed account, it *will* later be a part of the car since it is both an atemporal part of the car and existent at the later time

In describing the changing composition of an event, we do not appeal to events that predate or postdate the given event In describing the changing composition of today's lightning, for example, we do not mention events that began yesterday or will end tomorrow, and similarly, in describing the varying composition of a thing or event through space, we do not mention things or events that do not lie within the spatial boundaries of the given thing or event However, in accounting for the changing composition of a thing through time, we *will* characteristically appeal to things that predate or postdate the given thing A tire that is now a part of a car, for example, may have been manufactured before the car or may survive the car

There appears to be a fundamental difference in our conception of relative part in the two kinds of case When it comes to the relative parts of events in space or time or the relative parts of things in space, the relativity does not properly belong to the notion of parthood at all As the above conjunctive analysis makes clear, the *underlying* notion of parthood is not relative to the dimension in question and the relativity qualifies the manner of presence of the part rather than the relation of parthood itself But when it comes to the relative parts of things in time, the relativity does appear to qualify the relation of parthood rather than the manner of presence of the part There appears to be a genuinely relative sense in which the one thing stands in the relation of parthood to the other[8]

What can account for this remarkable difference in our conception of changing composition in the two kinds of case? For the 3D-er it is, of course, no accident that the difference in the cases aligns up exactly with his distinction between existence and extension But to understand why this should be so, we need to delve more deeply into our conception of part-whole

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[8] It is for this reason that we may meaningfully talk of a thing gaining or losing or retaining its parts though not of an event gaining or losing or retaining its parts

Parthood is a form of presence—not presence simpliciter but presence *in* For one object to be a part of another is for it to inhere or be present in the other It is a characteristic feature of parthood that when one object is part of another it is *wholly* present in the other One object is not part of another through having a part that is present in the other A gallon of milk, for example, is not a part of a quart through containing a pint that is present in the quart

When it comes to the relative notion of part, we would expect the characteristic features of parthood to be preserved—but subject, of course, to whatever kind of relativity is in question Thus if one object is, at a given time, part of another, then we would expect it, at that time, to be wholly present in the other But this entails that it should be wholly present at the given time For how can one object be wholly present in another without being wholly present?

We thereby arrive at the following significant requirement on the notion of relative part when one object is a part of another at a given time or place, it should be wholly present at that time or place This requirement, in its turn, has significant implications for the application of the notion of relative part to things and events A thing will be wholly present at each moment of the period of time throughout which it exists, and so we may properly talk of a thing being a part of something else at any given moment of its existence An event, on the other hand, will not be wholly present at each moment of the period of time during which it occurs but only at the period of time itself, and so we can only properly talk of an event being part of something else at the whole period of time during which it occurs There is perhaps a derivative sense in which we may talk of an event being a part at a moment but only because that moment belongs to the whole period of time throughout which the event occurs and is a part

These considerations therefore account for the difference in our conception of relative part In the case of things, the relativity can be seen to qualify the notion of parthood itself and it will be possible for there to be variation in whether one thing is a part of another at the different moments at which it exists But in the case of events, the relativity merely serves to qualify the period of time throughout which the event occurs The underlying notion of parthood is not itself relative to time, and variation in when one event is part of another will not be possible (Similar considerations apply to the spatial case)

But how is the 4D-er to account for the difference in conception? He cannot appeal to the 3D-er's distinction between existence and extension and, in the absence of this distinction, it is not clear what he might say He can, of course, agree that there are these different notions of part and that we bring the one notion to bear in the one case and the other notion to bear in the other cases But this still does not explain why we should apply the two different notions in the way we do

We should also note that the notion naturally applicable in the one kind of case is of dubious applicability to the other kind of case This is of no difficulty for the 3D-er since he can account for the inapplicability in terms of his distinction between existence and essence Thus events do not have temporary parts in the manner of things since they do not exist in time and things do not have temporary parts in the manner of events since they are not extended in time However, no such explanation is available to the 4D-er and so it seems that he should accept that the two notions of temporary part should apply across the board to both events and things

But consider the chime that is now a part of the ringing of the doorbell What would be the analogue of this for things? It would have to be something like this temporal part of the car now being a part of the car But this is plausible as a case of temporary part only if one already accepts the 4D-er's position

The analogy is even more difficult to maintain in the other direction The tire is now a part of the car What would be the analogue of this for events?[9] That this series of C-chimes (stretching way into the past and future) is now a part of the ringing of the doorbell? This is a decidedly odd way of talking of temporary part It is also not clear that it is the analogue of the notion of temporary part for things For it seems to be based upon the idea that one object will be a part of another at a given time if the temporal part of the first object at the given time is an atemporal part of the second object Thus it is only because the current temporal part of the series of C-chimes is a part of the ringing of the doorbell that we are willing to say that the series itself is now a part of the ringing of the doorbell

This criterion of temporary part violates what we have taken to be fundamental to the notion For we have supposed that if one object is a part of another, then it is wholly present in the other This may reasonably be thought to entail that if one object is a part of another then it is not a part through having a part that is a part of the other Extending this principle to the case of temporary part, we then have that if one object is a part of another at a time then it is not a part at the time through having a part that is a part of the other at the time But the proposed criterion is in direct conflict with this principle since it takes an object to be a temporary part of another via its temporal part

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[9] I here have "episodic" events in mind rather than "ongoing" events or processes One might perhaps argue for a closer analogy to things in the case of processes

The criterion also leads to absurdities on its own account For take the fusion of Cleopatra and the tire The 4D-er may well take there to be such a thing But given that there is, it should, by the criterion, be a current part of the car Yet surely nothing that contains Cleopatra as a part can currently be a part of the car [10]

These considerations strongly suggest that the criterion does not give us the notion of temporary part that we are after and, in the absence of any plausible alternative, we may conclude that the 4D-er has no basis for thinking that the notion of temporary part that we naturally apply in the case of things will have any genuine application in the case of events

I have presented a large body of data—from the language of location and our thinking about part-whole—that seems strongly to support the 3D position The 3D-er is able to provide a single satisfying explanation of the data, the 4D-er is not But how seriously should the 4D-er takes these arguments? Might he not simply respond to them by claiming that our language is deficient and our thought in error?

In considering this question, it is important to bear in mind the particular way I have characterized the 3D/4D dispute and the particular arguments I have advanced in favor of the 3D position On the usual way of characterizing the dispute, it concerns the existence of temporal parts, with the 3D-er denying their existence and with the 4D-er affirming their existence Now when the dispute it so understood, it might indeed be claimed that the 4D-er's position is at odds with how we ordinarily speak or think For we do not ordinarily take there to be a notion of temporal part or suppose that there are temporal parts

But the conflict with our ordinary thought is relatively benign in this case For the 4D-er is simply proposing an addition to our ordinary way of thinking, taking there to be concepts that we do not ordinarily acknowledge and taking there to be objects that we do not ordinarily take to exist Such additions to our thinking are familiar from science and mathematics and are even perfectly consonant with our ordinary way of thinking as long as its purview is limited to the objects it takes to exist

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[10] Difficulties of this sort are further discussed in my paper, "Things and Their Parts," in Peter A French and Howard K Wettstein, eds , *New Directions in Philosophy Midwest Studies in Philosophy,* Volume XXIII (Malden, MA Blackwell, 1999), pp 61–74

However, the conflict is much more serious in the present case In the first place, the 4D-er is not simply extending our current repertoire of concepts, he is supposing that some of the concepts we take ourselves to have are not genuinely intelligible In the second place, he must dismiss a good many of our ordinary judgments even when they are restricted to the objects of our ordinary ontology Although his theory may reasonably be expected to explain the truth of these judgments, he must maintain either that the judgments are mistaken or that there is no explanation of their truth Such a lack of respect for our ordinary way of thinking is not to be taken lightly and it is only the most compelling considerations on the other side, which I very much doubt exist, that could possibly lead us to condone it

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ARISTOTLE'S MEREOLOGY AND THE STATUS OF FORM

Like many of his contemporaries and predecessors, Aristotle was puzzled by what we may call, "The Problem of the One and the Many," namely how and whether something that has *many* parts can at the same time be *one*. He states this problem very clearly in *Physics* I 2, where it is listed as among the questions concerning parts and wholes to be dealt with (somewhere):

> There is, indeed, a difficulty about part and whole, perhaps not relevant to the present argument, yet deserving consideration on its own account—namely, whether the part and the whole are *one* or *more than one*, and in what way they can be one or many, and, if they are more than one, in what way they are more than one (*Phy.* I 2, 185b11–14, my emphasis).[1]

Aristotle returns to the Problem of the One and the Many in the central books of the *Metaphysics*, and applies some of the apparatus he has developed in the interim to these questions concerning parts and wholes. In particular, in a difficult but fascinating passage at *Met.* Z 17, 1041b11–33, which will be cited in full and discussed in detail below, Aristotle is concerned to put forward a proposal, by means of a regress argument, designed to explain in the case of things that are "compounded" (σύνθετον), rather than "simple" (ἁπλοῦν), how a whole is "one" (ἕν) and "not like a heap" (σωρός) (*Met.* Z 17, 1041b11–12).[2] Very schematically, Aristotle suggests there that wholes, unlike heaps, contain or have present in them "something else" (ἑτερόν τι) besides their *elements* (στοιχεῖα) or *matter* (ὕλη), namely *form* (εἶδος) or *essence* (τὸ τί ἦν εἶναι),[3] and that it is the presence of this additional component which accounts for the unity observed in wholes that is lacking in heaps.[4] In general, Aristotle finds the "whole"/"heap"

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[1] All translations in what follows come from Jonathan Barnes, ed., *The Complete Works of Aristotle: The Revised Oxford Translation*, Volume One and Two (Princeton University Press, 1984), with two small exceptions where I have emended W. D. Ross's translation of the *Metaphysics* as indicated below.

[2] Often, the Greek term Aristotle uses to denote wholes is 'ολον'; however, in the passage at issue, the term translated as "whole" is 'τὸ πᾶν', literally "the all"; a similar use of 'τὸ πᾶν', to contrast with 'σωρός' ("heap"), can also be found at *Met.* H 6, 1045a8–10.

[3] In what follows, I shall use the terms, 'form' and 'essence', interchangeably, since the goals of the present discussion are not to engage with Aristotle's conception of substance as a whole, but are rather more specifically mereological; I believe that nothing much hangs on this identification.

[4] It is not obvious that *Met.* Z 17 itself contains much, if any, information on the question of *how* Aristotle thought form could help account for the sort of unity that

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distinction to be a useful tool, to which he appeals at various places within and outside the *Metaphysics*, to contrast mereologically complex objects which he takes to be genuinely one or unified (wholes) with mereologically complex objects which lack the sort of unity under discussion (heaps) [5,6]

In this paper, I examine two central issues to which Aristotle's proposal in *Met* Z 17, concerning the role of form as the unifier of wholes or matter/form-compounds, gives rise (i) the question of whether form itself is to be viewed, literally and strictly speaking, as *part* of the matter/form-compound, and (ii) the question of whether form is to be regarded as itself *having* parts [7]

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is present in wholes and absent in heaps On one reading of the text, Aristotle answers this latter question in *Met.* H 6, by appeal to the *potentiality/actuality* distinction, if only by dismissing that there is in fact a genuine *problem* concerning the question of how matter and form are one (see also *DA* II 1, 412b4–9 for a similarly dismissive approach to the unity of matter/form-compounds) However, *Met* H 6 has also been read in a different way as concerning primarily the unity of form itself, and in general that of entities without matter, and as giving a deflationary answer as well for why these entities are one, namely, because they have their unity in a primitive underived way, see, for example, Verity Harte, "Aristotle *Metaphysics* H 6 A Dialectic with Platonism," *Phronesis*, XLI (1996) 276–301, for a reading of this kind (More on the unity of form in section II below)

[5] The "whole"/"heap" distinction is sometimes used even with respect to objects that are not material in any ordinary sense, see for example *Met* H 3, 1044a2–6, for an application to the case of definitions and numbers A prominent use of this distinction is to be found in a much-discussed passage at *Met* H 6, 1045a9 See, for example, Paul A Bogaard, "Heaps or Wholes Aristotle's Explanation of Compound Bodies," *Isis*, LXX, 251 (1979) 11–29, note 4, for a variety of uses of the term, 'σωρός' ("heap"), of course, not all of these uses contrast heaps with wholes, for sometimes Aristotle uses his term for heap in a nonmetaphysical way, just to talk about a bunch, pile, aggregate, conglomeration, and so on, of things, without commenting on the fact that the things under discussion fail to compose a genuinely unified entity

[6] I use the expression, 'mereologically complex object', neutrally to mean simply an object which has (proper) parts, as we will see, Aristotle's conception of wholes in many places is such that not every mereologically complex object qualifies as a whole (for example, in the context at hand, heaps do not) Mereologically complex objects thus contrast with what mereologists call "atoms," that is, objects which are treated by the theory in question as not further divisible into proper parts "Proper parts" are to be distinguished from "improper parts" the former are numerically distinct from the objects whose parts they are, the latter are numerically identical to the objects whose parts they are, the relation of proper parthood is therefore *irreflexive*, while the relation of proper or improper parthood is *reflexive* (that is, a thing is its own improper part, but not its own proper part)

[7] I take it to be an open question whether our mereological concepts are correctly described by "standard mereology," the classical statement of which in English, using the language of first-order predicate-logic, is Henry S Leonard and Nelson Goodman, "The Calculus of Individuals and Its Uses," *Journal of Symbolic Logic*, V (1940) 45–55 Thus, when I say 'part' I do not necessarily have in mind the part-relation described by this particular axiom system

The first question arises as follows Since form is invoked in *Met* Z 17 to answer at least a particular incarnation of the question of how a thing that has parts can nevertheless be one or unified, it is thought that form *therefore* cannot itself *be* a part of the composite object it is intended to unify, moreover, Aristotle is read in *Met* Z 17 as himself *saying* that this is so [8] According to this anti-mereological reading, Aristotle argues in the passage at issue that the "something else," namely *form*, whose presence apparently distinguishes wholes from heaps, cannot be considered a further *part* [μέρος] of the compound, since otherwise a regress of some sort will ensue More generally, it would seem, on this approach, that *Met* Z 17 provides reasons which would count against *any* version of what we might call *mereological hylomorphism*, that is, any account which not only views wholes as compounds of matter [*hylē*] and form [*morphē*], but which also takes both of these components (and, in particular, form) to be themselves *parts*, strictly and literally speaking, of the whole they compose I thus consider it to be a matter of some importance, both for those interested in ancient conceptions of parthood and composition and for those approaching these issues from a contemporary angle, to examine whether, despite his remarks in *Met* Z 17, Aristotle himself should be read as subscribing to a *mereological* version of the hylomorphic view, and whether, more generally, mereological versions of the hylomorphic approach to parthood and composition are indeed susceptible to a regress argument of the kind with which we seem to be confronted in *Met* Z 17 [9]

The second question I want to examine in what follows concerns the unity of form itself For we may wonder how it is that form can play the role of unifier-of-wholes, when Aristotle at the same time seems to be committed to the view that form itself, in the guise of definition, is *mereologically complex*; the parts of form are repeatedly identified as the parts of definition, namely, the genus and the differentiae[10] The possibility that form itself is mereologically complex would appear to give rise to a new version of the Problem of the One and the Many If form itself has parts, then how is *it* one, rather than many? What, if anything, could act as the *further* principle of unity which holds together the parts of form? Unless this quandary can be put to rest in some way, either by meeting it head-on or by rejecting some of its presuppositions, the unity of form is called into question and, with it, also that of matter/form-compounds, which are said to depend on form as their source of unity[11]

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[8] See, for example, Harte, *Plato on Parts and Wholes The Metaphysics of Structure* (New York Oxford, 2002), p 11 Similar cautionary remarks, though not necessarily specifically with respect to Aristotle's regress argument in *Met* Z 17, against taking form to be yet another part of the matter/form-compound are not uncommon see, for example, Wilfred Sellars, "Aristotle's *Metaphysics* An Introduction," in *Philosophical Perspectives* (Springfield, IL C C Thomas, 1967), pp 73–124, p 118, J L Ackrill, "Aristotle's Definition of *Psychê*," *Proceedings of the Aristotelian Society*, LXXIII (1972–73) 119–33, David Bostock, *Aristotle, Metaphysics, Books Z and H*, translated with a commentary (New York Oxford, 1994), p 229, Theodore Scaltsas, *Substances and Universals in Aristotle's Metaphysics* (Ithaca Cornell, 1994), chapters 4–5, and Michael V Wedin, *Aristotle's Theory of Substance The Categories and Metaphysics Zeta* (New York Oxford, 2000), p 440 For discussion of this issue, see also Frank Lewis, "Aristotle on the Unity of Substance," *Pacific Philosophical Quarterly*, LXXVI (1995) 222–65, and "Substance, Predication, and Unity in Aristotle," *Ancient Philosophy*, XV (1995) 521–49

[9] A contemporary version of mereological hylomorphism is considered and rejected by Mark Johnston in "Parts and Principles False Axioms in Mereology," *Philosophical Topics*, XXX, 1 (2002) 129–66, pp 162ff , Johnston himself advocates a *non*mereological hylomorphic approach to parthood and composition

I THE REGRESS ARGUMENT IN *METAPHYSICS* Z 17

Let us begin then by examining the passage at issue from *Met* Z 17

> As regards that which is compounded [σύνθετον] out of something so that the whole [τὸ πᾶν][12] is one—not like a heap [σωρός], however, but like a syllable,—the syllable is not its elements [στοιχεῖα], ‘ba’ is not the same as ‘b’ and ‘a’, nor is flesh fire and earth, for when they are dissolved the wholes, i e, the flesh and the syllable, no longer exist, but the elements of the syllable exist, and so do fire and earth[13] The syllable, then, is something -not only its elements (the vowel and the consonant)

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[10] For example, according to the fifth sense of ‘part’ Aristotle distinguishes in his entry on ‘part’ in the “Philosophical Lexicon” (*Met* Δ 25), “the elements in the formula which explains a thing” (for example, the genus) are there called parts of the form (εἶδος) (*Met* Δ 25, 1023b23–25), and the form is also, interestingly, itself referred to as a whole a few lines earlier at 1023b20

[11] This second question concerning the unity of form is explicitly discussed, for example, in Harte, “Aristotle *Metaphysics* H 6 A Dialectic with Platonism,” as well as Montgomery Furth, “Aristotle on the Unity of Form,” *Boston Area Colloquium in Ancient Philosophy*, II (1987) 243–67

[12] ‘Τὸ πᾶν’ is also the term used by both Plato and Aristotle to distinguish “mere” mereological sums or aggregates from genuine wholes (ὅλον), ‘τὸ πᾶν’ is for example used in Aristotle’s entry on ‘whole’ in his “Philosophical Lexicon” (*Met* Δ 26) for what Ross there translates as “totals,” that is, entities such as water which in Aristotle’s view lack the requisite degree of unity to be considered genuine wholes But in the current context Aristotle is clearly using the term, ‘τὸ πᾶν’, in a broader sense, to include genuinely unified wholes as well, and is primarily interested in differentiating such a whole from a mere heap (σωρός)

[13] Notice that Aristotle is here appealing to a Leibniz’s Law-style argument for the numerical distinctness of wholes and their elements Aristotle’s reasoning is that because a whole and its elements do not share all of the same characteristics (in this case, persistence conditions), they cannot be numerically identical (reading ‘the same’, in this context, as denoting the relation we would now call “numerical identity”), for the elements can survive “dissolution,” while the whole cannot Aristotle’s employment of the concepts, “one” and “same,” do not always map in a completely straightforward way onto our contemporary notions of numerical identity and qualitative similarity, see, for

> but also something else [ἕτερόν τι], and the flesh is not only fire and earth or the hot and the cold, but also something else Since, then, that something must be either an element or composed of elements [ἐκ στοιχείων εἶναι], (1) **if it is an element the same argument will again apply**, for flesh will consist of this and fire and earth and something still further, **so that the process will go on to infinity**, while (2) **if it is a compound**, clearly it will be a compound not of one but of many (or else it will itself be that one),[14] so that again in this case we can use the **same argument** as in the case of flesh or of the syllable But it would seem that this is something, and not an element, and that is the cause [αἴτιον] which makes *this* thing flesh and *that* a syllable And similarly in all other cases And this is the substance [οὐσία] of each thing, for this is the primary cause of its being, and since, while some things are not substances, as many as are substances are formed naturally and by nature, their substance would seem to be this nature [φύσις], which is not an element but a principle [ἀρχή] An *element* is that into which a thing is divided and which is present in its as matter [ὕλη], e g 'a' and 'b' are the elements of the syllable (*Met* Z 17, 1041b11–33, Ross's italics, my boldface)

Without attempting to do justice to all the intricacies of this rich and difficult passage, I want to comment now on just those features of Aristotle's argument, which are immediately relevant to the first question identified above, namely whether the regress argument put forward in *Met* Z 17, in Aristotle's own view or from the perspective of the contemporary theorist, should be read as providing general

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example, Stephen Makin, "Aristotle on Unity and Being," *Proceedings of the Cambridge Philological Society*, CCXIV (1988) 77–103, for discussion

By "Leibniz's Law," I mean the metaphysical principle concerning objects, properties and relations, also known as the *Indiscernibility of Identicals*, according to which numerically identical objects are qualitatively indiscernible (that is, for any objects, *x* and *y*, if *x* is numerically identical to *y*, then any properties and relations that apply to *x* also apply to *y*) This fairly innocuous principle is to be distinguished, first, from the much more controversial principle known as the *Identity of Indiscernibles*, which asserts conversely that qualitatively indiscernible objects are numerically identical, and, second, from various *linguistic* principles concerning the intersubstitutivity *salva veritate* of co-referential expressions, which are sometimes called by the same name, see my "Almost Indiscernible Objects and the Suspect Strategy," this JOURNAL, CII, 2 (February 2005) 55–77, for discussion

[14] I read Aristotle here as appealing to what Peter Simons calls the "Weak Supplementation Principle," according to which an object which has a proper part must have at least another proper part disjoint from (that is, not overlapping or sharing parts with) the first, see Simons, *Parts A Study in Ontology* (New York Oxford, 1987), p 28 Similarly, a compound, Aristotle says, cannot be composed of just one element, since the object in question would then be identical to its sole element (reading 'being that one' again as denoting in this context the relation contemporary metaphysicians call "numerical identity")

reasons against a mereological hylomorphism, that is, against taking form to be yet another *part* of the whole or matter/form-compound In what follows I develop a negative answer to this question [15]

According to the reading of *Met* Z 17 I want to recommend, the passage just cited concerns the *second* of two broad categories between which Aristotle differentiates in the current context, namely, (i) things that are *simple* (ἁπλοῦν) and (ii) things that are *composite* (σύνθετον) In the lines just preceeding the passage cited, Aristotle tells us that whatever proposal concerning unity is about to follow does not apply to things in category (i), that is, those that are simple, but only to things in category (ii), that is, those that are composite

> Evidently, then, in the case of *simple* things no inquiry nor teaching is possible, but we must inquire into them in a different way (*Met* Z 17, 1041b9–11, my emphasis)

Perhaps, he has in mind here that the unity of things that are simple is not problematic in the same way in which the unity of composite things is problematic, precisely because the former are simple and the latter are composite, and perhaps he is thinking of form as an example of a kind of item which belongs into the category of simple things, since arguably its unity must be taken for granted, if form is to play the role of unifier of at least some of the items in category (ii) We may leave these questions concerning the unity of form open for now (though we will return to them below), since our present concern is primarily with Aristotle's remarks in *Met* Z 17 regarding the *second* category, namely, things that are composite, moreover, Aristotle in any case brings up the category of simple things in the passage just cited only to exclude it from whatever proposal he is about to put forward [16]

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[15] My reading of *Met* Z 17 is referred to in a very condensed fashion in my review of Harte's *Plato on Parts and Wholes*, this JOURNAL, CI, 9 (September 2004) 492–96, for a more detailed development of my views concerning Aristotle's mereology, as well as concerning Harte's reading of Plato's theory of parts and wholes, see my *The Structure of Objects* (in progress), especially chapters 4–5

[16] Many of the commentators take Aristotle as having in mind forms under the rubric of 'ἁπλᾶ' ("simple things"), see, for example, M F Burnyeat et al , *Notes on Book Zeta of Aristotle's Metaphysics* (Study Aids Monograph No 1, Subfaculty of Philosophy, Oxford, 1979), p 155, as well as Michael Frede and Günther Patzig, *Aristoteles, Metaphysik Z*, Text, Übersetzung und Kommentar, Zweiter Band (Munich C H Beck, 1988), p 318 That "no inquiry nor teaching is possible" in the case of simple things is typically taken to mean that a *different* method of inquiry and/or teaching is applicable to the case of simple things, that is, different from that which is applicable to the case of composite things, not that *no* inquiry or teaching whatsoever is possible as Aristotle goes on to say, "we must inquire into them in a *different* way" (my emphasis)

Among items in category (ii), that is, things that are composite, Aristotle evidently wishes to distinguish two further sub-categories, namely, (ii a) *wholes*, or things that are *one*, like a syllable or flesh (his examples here for items that belong into category (ii a)),[17] and (ii b) *heaps* (for which he gives no direct examples in the passage under discussion) His proposal at 1041b11–33 concerns the question of how to draw this second distinction, between items in category (ii a), wholes, and items in category (ii b), heaps, both of which are taken to be composite

The regress argument found in the middle of the passage at issue is meant to rule out a particular way of construing what it means to be a whole, which would collapse the category of wholes into the category of heaps, and this regress argument itself consists of two sub-cases

> Since, then, that something [present in wholes but absent in heaps] must be either an element or composed of elements, (1) *if it is an element the same argument will again apply*, for flesh will consist of this and fire and earth and something still further, *so that the process will go on to infinity*, while (2) *if it is a compound*, clearly it will be a compound not of one but of many (or else it will itself be that one), so that again in this case we can use the *same argument* as in the case of flesh or of the syllable (*Met* Z 17, 1041b19–25, my italics)

Case (1) considers the possibility that the "something else," which Aristotle thinks is present in wholes but absent in heaps, is itself a further element, Case (2) considers the scenario in which the "something else" in question is a composite entity, composed solely of elements Case (2) reduces to Case (1) for suppose we are dealing with a compound that is composed of further compounds, and so on, we can then ask about each of these smaller compounds what *they* are in turn composed of, and so on, until we get to a compound which is composed, not of further compounds, but of elements, in which case we now have something that has the shape of the first case

Case (1), and hence Case (2) as well, in Aristotle's view, leads to a regress (For the sake of simplicity, let us focus simply on Case (1), since Aristotle does not take Case (2) to introduce any significantly new considerations) Suppose, then, we take the "something else" in question, which is present in a whole but absent in a heap, to be itself an element for example, we might propose that what makes flesh a genuinely unified whole, rather than a heap, is the hitherto unrecognized presence of (say) *water*, in addition to its previously recognized elements, fire and earth [18] This proposal, so Aristotle reasons implicitly, would only leave us with a slightly "bigger" heap, that is, an object consisting now of the elements, fire, earth and water, but we would not thereby have succeeded in explaining what makes flesh a genuinely unified whole in the first place (To illustrate why water cannot play the required role of unifier-of-whole, we might for example appeal again to the kind of Leibniz's Law-style argument for the numerical distinctness of wholes and their elements, to which Aristotle himself appeals just a few lines earlier for fire and earth *and water* can all exist in isolation as well, without flesh existing, but flesh cannot exist once its elements have been dissolved)[19] Thus, the same question about the unity of wholes arises again, now about this new collection of elements consisting of fire, earth, and water why do these elements compose a genuinely unified whole, rather than a heap? Using the same method as before, we would now have to point to a new element, for example, air, and the process will go on to infinity

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[17] It is frequently pointed out that Aristotle may, at the end of the day, view neither the syllable nor flesh as a genuine example of a unified entity (the syllable, because it is an artifact, and flesh, because it is present in an organism only potentially), it is, however, common Aristotelian practice to illustrate a metaphysical point by means of examples which may not fully instantiate the category under discussion a case in point is Aristotle's widespread appeal to artifacts to illustrate distinctions which apply only to full-fledged substances, despite the fact that he is ambivalent about the status of artifacts within his metaphysics

To break out of this cycle, Aristotle proposes that we consider a *third* option [20] the "something else" in question, that is, form, which is present in wholes but absent from heaps, must belong to a *distinct ontological category*, that is, different from that of elements or entities which are composed exclusively of elements, he calls this new sort of constituent, a "principle" (ἀρχή), and aligns it at the end of the passage with form/essence, by way of the concepts, "cause" (αἴτιον), "nature" (φύσις) and "substance" (οὐσία) (in the relative sense of 'substance *of*'), while the category of elements is explicitly associated at the end the chapter with matter

On the reading of *Met* Z 17 I am recommending, then, Aristotle does not actually argue in the cited passage that a regress results in itself from taking the "something extra," that is, form, to be a *part* of the compound rather, a regress threatens, in his view, only if the

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[18] I am here construing 'element' in a very literal fashion as denoting one of the four elements, that is, water, fire, earth, or air Clearly, Aristotle thought that his notion of element was more widely applicable, but I take it that my very literal example does not distort Aristotle's point in the passage currently under consideration

[19] I have in mind here of course *living* flesh, that is, flesh that is part of a living organism, dead flesh, that is, flesh that has been separated from the living organism of which it was part, is in fact, by Aristotle's *Homonymy Principle*, flesh "in name alone," and is likened to a heap, for example, at *Met* Z 16, 1040b5–10

[20] I thus take Aristotle not completely seriously when he seems to suggest at 1041b19–20 that the "something else" in question "*must* be either an element or composed of elements" (my emphasis), as though Case (1) and Case (2) are our *only* two options

"something extra" in question is taken to be *of the same ontological kind* as the other components which make up a genuinely unified whole, be they mereologically basic (that is, elements) or mereologically complex (that is, compounds of compounds that are themselves composed solely of elements) The point of Aristotle's regress argument instead is to argue that genuinely unified wholes must be not only mereologically complex but also *ontologically complex*; that they must consist of entities which belong to distinct ontological categories, namely, form and matter, or principle and element[21]

The explicitly anti-mereological reading of *Met* Z 17, in contrast, turns on taking 'element' as synonymous with 'part'[22] And while *Met* Z 17 itself does not explicitly legislate on the question of

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[21] On my reading of *Met* Z 17, Aristotle in this context thus takes heaps, as contrasted with genuinely unified wholes, to be entities which are mereologically complex but ontologically simple, in that they consist merely of elements, but lack a principle that "ties together" the elements into a genuinely unified whole Wholes, on the other hand, in *Met* Z 17 are taken to be exclusively objects that are unified under a single form In light of what Aristotle says elsewhere, however, for example, in his entries on 'part' and 'whole' in *Met* Δ 25–26, it is sometimes more plausible to construe his use of the term, 'whole', more broadly, as applying also to objects that are mereologically complex and unified under *some* principle of unity (though not necessarily form), under this wider usage, then, the objects which are here called "heaps" might also count as wholes, namely, as objects that are mereologically complex and not unified under a single form, though possibly under a different, weaker, principle of unity, for example, a band which enforces physical contact among the wooden sticks in a bundle of wood might count as an example of a principle of unity of this kind that is weaker than form

For a similar reading of *Met* Z 17, see, for example, Theodore Scaltsas, "Substratum, Subject, and Substance," *Ancient Philosophy*, v (1985) 215–40, and Sally Haslanger, "Parts, Compounds and Substantial Unity," in Scaltsas, D Charles, and M L Gill, eds , *Unity, Identity, and Explanation in Aristotle's Metaphysics* (New York Oxford, 1994), pp 129–71

[22] This further step is for example taken by Harte, after quoting a section from Aristotle's text, she says

> This "something else" is not a further *part* of the whole (cf 1041b25-7), but it is rather its nature (φύσις) and principle (ἀρχή) (1041b30-1), and this, although Aristotle does not here explicitly use the term, is form (εἶδος) (Harte, *Plato on Parts and Wholes*, p 133, my emphasis)

Although she does not say this explicitly in her book, Harte's unpublished Ph D dissertation suggests that she may have had in mind a reading of Aristotle which holds that form *is* a part of the compound, but only according to a sense of parthood ("formal part") distinct from that which applies to matter ("material part"), see her *Parts and Wholes Plato, Aristotle and the Metaphysics of Structure* (Cambridge St Edmund's College, 1994) This reading leaves open the possibility that 'element' in *Met* Z 17 may be taken as synonymous with 'part', as long as we are careful to understand 'part' in this context as meaning material part, moreover, on this reading, form would still come out as a proper part of the matter/form compound according to its own separate sense of 'part' ("formal part") Although I acknowledge that Aristotle often talks as if he means by 'part' material part, I take him in these contexts merely to be using a convenient shorthand, in what follows, I offer both textual and conceptual reasons against reading Aristotle as distinguishing a "formal" from a "material" sense of parthood whether form and matter are themselves *part* of the matter/form-compound,[23] a convincing case can, I think, be made for such a mereological construal of Aristotle's hylomorphism, once we combine his arguments in *Met.* Z 17 with the following textual and conceptual considerations.

For one thing, Aristotle explicitly says in certain places that form and matter are both *part* of the matter/form-compound, as the following passage from *Met.* Δ 25 (his fourth notion of 'part') illustrates:

> Those into which a whole is divided, or of which it consists—the 'whole' meaning either the form or that which has the form, e.g., of the bronze sphere or of the bronze cube both the bronze—i.e., the matter in which the form is—and the characteristic angle are *parts* [μέρος] (Met. Δ 25, 1023b19–22, my emphasis).[24]

This passage, somewhat obscurely, makes the point that both matter (the bronze) and form (the characteristic angle) are *part* of the matter/form-compound (the bronze sphere or cube). A striking feature of this passage from *Met.* Δ 25 is that Aristotle explicitly takes the form and the matter to be part of the compound *according to a single sense of 'part'*; in other words, we do *not* find in *Met.* Δ 25, where his business is to say in how many ways 'part' is spoken of, *two separate* entries along the lines of " and 'part' is spoken of in *one* way as the matter is part of the compound, and in *another* way as the form is part of the compound ”[25] And while I of course concede that Aristotle speaks less often explicitly of the form as being itself part of the compound than he speaks of the matter as being part of the compound, I nevertheless want to urge that we accept both of these commitments as official Aristotelian doctrine [26]

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[23] Here I am in agreement with Haslanger, who also endorses a *mereological* reading of Aristotle's hylomorphism, but takes *Met.* Z 17 in itself to be neutral on the question of whether 'part' can or should be read as synonymous with 'element' (see her "Parts and Compounds"). As I am about to suggest, however, I do think that the overall textual and conceptual evidence supports a mereological reading of Aristotle's hylomorphism. In a series of papers, Kit Fine has also defended a mereological hylomorphism, both as an interpretation of Aristotle and as the *correct* conception of parthood and composition from the perspective of contemporary metaphysics; see especially his "Acts, Events and Things," *Language and Ontology, Proceedings of the 6th International Wittgenstein Symposium* (Vienna: Hölder-Pichler-Tempsky, 1982), pp. 97–105; "Aristotle on Substance" (unpublished manuscript, 1983); "Aristotle on Matter," *Mind*, CI (1992): 35–57; "A Puzzle Concerning Matter and Form," in Scaltsas, Charles, and Gill, eds., *Unity, Identity and Explanation in Aristotle's Metaphysics*, pp. 13–40; "The Problem of Mixture," *Pacific Philosophical Quarterly*, LXXVI (1995): 266–369; "Mixing Matters," *Ratio*, XI, 3 (1998): 278–88; and "Things and Their Parts," *Midwest Studies in Philosophy*, XXIII (1999): 61–74.

[24] I have here emended Ross's translation by rendering his "the *elements* into which a whole is divided," in the first sentence of the cited passage, simply as "*those* into which a whole is divided," which, though less elegant in English than Ross's rendition, is closer to the text. The text does not contain an occurrence of the word, 'στοιχεῖα', with which we have just been concerned in the context of *Met.* Z 17; rather, it contains merely a neuter plural relative pronoun, that is, something closer to the more literal '*those* into which a whole is divided'; 'elements' is inserted by Ross simply to fill out the meaning of the pronoun and is thus best construed in a neutral nontechnical fashion. Since Ross's insertion of 'the elements' might be confusing in the context of the present discussion, since we have also been concerned with the technical use of the term, I have found it best simply to omit it from the passage at issue.

In fact, given Aristotle's commitments, he does not have much choice, if he wants to avoid inconsistency, on whether to accept form literally as part of the matter/form-compound, according to the *same* sense of parthood in which matter is said to be part of the matter/form-compound The commitments which are relevant to establish this outcome are the following three in particular (i) Aristotle's endorsement of what Peter Simons calls the “Weak Supplementation Principle” or (WSP),[27] (ii) his endorsement of a Leibniz's Law-style argument for the numerical distinctness of wholes and their elements or matter, and (iii) his quite explicit commitment to the view that the *matter* is literally part of the matter/form-compound

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[25] Form is also spoken of as part of a compound, for example, at *Met* Z 9, 1034a21–30, and very explicitly at *Met* Δ 18, 1022a32 “ for the soul, in which life directly resides, is a part of the man ” Both matter and form are often spoken of as being “in” the compound in a way that seems quite overtly mereological, as for example at *Met* Z 8, 1033b13–19 Matter is spoken of as part of the compound, for example at *Met* Z 7, 1032b32-33 In general, *Met* Z 7–9 is a good place to find this kind of language, since Aristotle is there explicitly concerned with the question of how compounds of matter and form are brought into existence from [ἐκ] pre-existing ingredients (See also Harte's PhD dissertation, *Parts and Wholes Plato, Aristotle and the Metaphysics of Structure,* for helpful discussion of the connections between the entries for 'part' and 'whole' in *Met* Δ 25–26 and the entry for 'from' which immediately preceedes them in *Met* Δ 24)

[26] Thus, it is of course undeniable that Aristotle often uses the term 'part' to single out merely the potentially existing matter-portion of a matter/form-compound It is this use of the term, 'part', that is most conducive to Harte's reading of the regress-argument in *Met.* Z 17, which takes 'part' to be synonymous with 'element' (which in turn is identified with 'matter') Among the numerous passages in which this use of Aristotle's term for part is prevalent, see, for example, *Phy* VIII 5, 250a24–25, where Aristotle states, apparently only focusing on matter/form-compounds, that “no part even exists otherwise than potentially within the whole”, see also the entry for 'cause' [αιτιον] in *Met* Δ 2, where Aristotle speaks of the parts as the material causes of the whole, as well as the entry for 'prior' and 'posterior' in *Met* Δ 11, especially 1019a8ff However, while I acknowledge that Aristotle often uses his term for part in this way, I take this usage to be mere shorthand for singling out the *nonformal* parts of a matter/form-compound

[27] Simons, *Parts A Study in Ontology*, p 28 See note 14 for what I take to be textual evidence within *Met.* Z 17, documenting Aristotle's endorsement of (WSP) Notice that at that moment within the dialectic of *Met* Z 17 all the parts of the compound are taken to be either (i) elements or (ii) composed exclusively of elements thus, *until* the “element”/“principle” distinction is introduced, it is appropriate to read 'part' as synonymous with 'element' (or 'compound of elements'), though *after* this distinction is introduced we must leave open the possibility that the compound has further parts besides its elements

The argument runs as follows Suppose, by (ii), that the matter of a matter/form-compound is numerically distinct from the matter/form-compound it helps to compose (since, for example, the elements or matter can exist in isolation, but the matter/form-compound ceases to exist as soon as the matter or elements are "dissolved")[28] Suppose further, by (iii), that the matter is a part of the matter/form-compound[29] Then, given (ii) and (iii), matter must be a *proper* part of the matter/form-compound for, by (iii), it is a *part* of the matter/form-compound and, by (ii), it is *nonidentical* to the matter/form-compound But, by (WSP), a whole cannot have a single proper part ('<' denotes the relation of proper parthood, '$\wr$' denotes disjointness, that is, the relation which holds among objects which do not overlap or share parts)

(WSP) *Weak Supplementation Principle* $(x<y) \rightarrow (\exists z)\ (z<y \ \&\ z \wr x)$

(WSP) states that if an object, *x*, is a proper part of an object, *y*, then *y* must have *another* proper part, *z*, besides *x*, which is disjoint from *x* for why else, one might wonder, would *x* be considered a *proper* part of *y*, as opposed to an *improper* part of *y*?[30] It follows, then, from (i), (ii) and (iii), that a matter/form-compound must have some *additional* proper part, besides its matter, and there is of course no better candidate, within Aristotle's ontology, for this additional part than form Thus, if Aristotle wants to retain his commitment to (i), (ii), and (iii), he is best served by endorsing a *mereological* version of his hylomorphism, that is, by taking form to be itself a proper part of the matter/form-compound, as he in fact explicitly states in *Met* Δ 25 and elsewhere Moreover, we might add that, if, contrary to the reading just suggested, Aristotle in fact had in mind a *non*mereological variety of the hylomorphic view, we may justifiably complain that his approach has not succeeded in elucidating the nature of matter/form-compounds until the *non*mereological composition-relation operative in this case has been further explicated, in this way, then, Aristotle himself would be subject to many of his own criticisms of the Platonist metaphysics, which in his view is overly reliant upon an unexplained mysterious participation-relation [31]

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[28] *Met* Z 17 certainly seems to speak in favor of Aristotle's endorsement of (ii), though a more detailed development of the current reading would have to account also for Aristotle's apparent statements to the contrary, for example, in *Met* H 6 Since, for reasons of manageability, I currently want to avoid getting entangled in issues concerning Aristotle's potentiality/actuality distinction, I refrain from commenting on these statements within the confines of the current discussion, but see, for example, Haslanger, "Parts and Compounds," for a reading of *Met* H 6 that makes room for a mereological construal of Aristotle's hylomorphism

[29] See, for example, *Met* Δ 25 as well as the passages cited in notes 25 and 26 for textual evidence that Aristotle did indeed support this claim

[30] I share Simons's view that (WSP) is an exceedingly plausible principle governing the part-relation, Simons in fact takes (WSP) to be *constitutive* of our notion of parthood

> How could an individual have a *single* proper part? That goes against what we mean by 'part' An individual which has a proper part needs other parts in addition to *supplement* this one to obtain the whole (Simons, *Parts A Study in Ontology*, p 26)

Even if one were to dispute my attribution of (WSP) to Aristotle on *textual* grounds, a good case can I think still be made that, whether or not Aristotle explicitly endorsed (WSP), he *ought* to have done so on the basis that (WSP) reflects one of the minimal formal requirements to which one must appeal in the course of bringing out the *genuinely mereological* character of the part-relation, as compared to other partial orderings (like 'is taller than')

I conclude, then, that the regress argument in *Met* Z 17 does not present convincing evidence against a mereological reading of Aristotle's hylomorphism, in fact, I have tried to suggest that, for the sake of consistency, we ought to take Aristotle literally when he states that both the form and the matter are proper parts of a matter/form-compound, strictly and literally speaking, and according to a single sense of 'part' This reading of Aristotle does of course leave us with the difficult question of how the unity of a whole *is* to be explained on a model which takes the "something extra," the *source* of the unity of the whole, as itself a proper part of the whole, alongside the remaining, nonformal components certainly, the mere recognition of a particular kind of ontological complexity within a genuinely unified whole by itself does not yet solve the mystery of *why* it is that these entities of distinct ontological types (in Aristotle's case, form and matter, or principle and element) can come together to produce a single genuinely unified thing But the existence of this *further* question does not in itself show that all mereological varieties of the hylomorphic conception must be abandoned in the face of the Aristotelian regress Certainly, Aristotle himself did not seem to interpret his own regress argument in this fashion, rather, he seems to have thought that his distinction between "elements" and "principles" solves the regress and that other aspects of his metaphysics would speak to the question surrounding the unity of wholes, in particular the actuality/potentiality distinction We should thus stick with the mereological interpretation of the hylomorphic approach, despite the regress, and deal with the problem of unity as best as we can After all, even the proponent of the nonmereological model, in addition to having to take recourse to an as-of-yet unexplained composition-relation, cannot completely escape the Problem of the One and the Many, if he is willing to allow, as seems plausible, that the *formal* component of a matter/form-compound may itself exhibit mereological complexity for the Problem of the One and the Many arises for anyone who recognizes genuinely unified wholes that are composed of many parts, even when both the whole and the parts in question are formal

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[31] The argument just offered for why we should read *Aristotle* as endorsing a mereological hylomorphism is schematically the same as that offered in my *The Structure of Objects*, chapter 6, for why *we* should endorse a mereological hylomorphism, as the correct theory of parthood and composition, from the perspective of the contemporary metaphysician

II IN SEARCH OF THE ULTIMATE MEREOLOGICAL ATOM

Let us turn now to the second difficulty isolated above which arises concerning the status of form within Aristotle's mereology, namely, the problem concerning the unity of form itself the question before us here is how form can serve in the role just identified in *Met* Z 17 as the unifier of matter/form-compounds, when Aristotle at the same time seems to be committed to the view that form, in the guise of definition, is itself mereologically complex, for he repeatedly speaks of the parts of form as corresponding to the parts of definition, namely, the genus and the differentiae [32] I take this problem concerning the unity of form to be among the most central problems to which Aristotle's analysis of parthood and composition leads, moreover, it is a problem not just for his mereology proper but for his metaphysics at large

At least in part to blame for the problematic status of form within Aristotle's mereology is the conceptual connection he sets up right from the start between the notions, "unity" and "indivisibility" "For in

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[32] Moreover, the problem just described is still with us, even if we ascribe to Aristotle the view (despite his occasional apparent pronouncements to the contrary) that form and definition cannot literally be *identified* (in the contemporary metaphysician's sense of "numerical identity") for definitions after all are plausibly construed as *linguistic* entities (comparable to, according to Aristotle, but nevertheless of course different from, say, literary works like the *Iliad*), while forms presumably are not plausibly so construed In that case, then, it might seem that, since definition and form are not literally identical, we need not expect the mereological structure of the one to mirror exactly that of the other Unfortunately, Aristotle puts obstacles in the way of this possible escape route by endorsing a fairly strong *correspondence* principle between the *parts* of a definition or formula and the *parts* of the object described by it

> Since a definition is a formula, and every formula has parts, and *as the formula is to the thing, so is the part of the formula to the part of the thing,* (*Met* Z 10, 1034b20–22)

Thus, the recognition that forms and definitions belong to distinct ontological categories (the latter being a linguistic entity, or formula (λόγος), the former being what is properly described by at least some of these linguistic constructions) therefore does not remove the worry concerning the unity of form, since Aristotle holds in addition that the association between forms and definitions requires that the mereological structure of definitions accurately reflect the mereological structure of the objects described by them general those things that do not admit of *division* [διαίρεσις] are *one* insofar as they do not admit of it, " (*Met* Δ 6, 1016b3–4) [33] Thus, to be *one*, in Aristotle's view, is at bottom to be *indivisible* (ἀδιαίρετον), this is the core meaning of the term, 'one' ('ἕν'), and the common thread that ties together all the different uses of this notion he discerns Moreover, Aristotle's continuation of the sentence just cited illustrates a feature of his conception of unity and indivisibility which is characteristic of the central notions of Aristotle's philosophy and which represents one of Aristotle's major innovations as compared to the metaphysical apparatus of his Platonist predecessors, namely, his *relativized* conception of unity or indivisibility " e g , if something *qua* man does not admit of division, it is one man, if *qua* animal, it is one animal, if *qua* magnitude, it is one magnitude" (*Met* Δ 6, 1016b5–6), in other words, to be *one* is always to be one *something-or-other*, the "something-or-other" in question supplies the *measure*, by means of which the thing in question is judged to be one or indivisible Thus, in typical Aristotelian manner, something can be said to be *one* (or *many*) in a particular way, but not in another, without contradiction, just as things can be said to *be* in one way and not in another to illustrate, 'ba' is taken by Aristotle to be *one* (syllable) because it is *indivisible* into parts relative to the measure, 'syllable', but it is also *many* (letters) because it is *divisible* into parts relative to the measure, 'letter'

Given Aristotle's link between unity and indivisibility into parts relative to some measure only an object that is a true *mereological atom*, that is, one that is indivisible relative to *all* conceivable measures in relation to which other objects turn out to be mereologically complex, could ever put to rest the threat of a never-ending demand for further principles of unity, by claiming to have its unity in a primitive and underived manner All other objects are found to be many or divisible into parts by some measure, and we may thus, given Aristotle's general outlook, continue to ask about these objects from what source they derive their unity There is in this way a powerful strand within Aristotle's thought according to which he has launched himself on a search for the ultimate mereological atom, and, despite the close ties between form and definition, there is evidence that Aristotle would like this search to end with form on this view, form, and in general all things which are *without matter*, and which, for this reason, are viewed as *pure actuality*, are *simple*, and therefore lack all mereological and ontological complexity

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[33] For the connection between 'one' and 'indivisible', see also, for example, *Met* I 1, 1052b16

This suspicion is confirmed by consulting two crucial texts, which also constitute the most detailed development of *examples* of Aristotelian forms, namely, the discussion of the soul in *De Anima* and that of God in *Met* Λ In *Met* Λ 7, for example, Aristotle is quite explicitly concerned to establish that God, the unmoved mover, is *without parts* (ἀμερής) and *indivisible* (ἀδιαίρετος), as the following passage illustrates

> It is clear then from what has been said that there is a substance which is eternal and unmovable and separate from sensible things It has been shown also that this substance cannot have any magnitude, but is *without parts* [ἀμερής] and *indivisible* [ἀδιαίρετος] (*Met* Λ 7, 1073a3–7, my italics)

Moreover, Aristotle goes to considerable lengths to argue in *Met* Λ 9 that the unmoved mover's activity (thought thinking itself) is directed at an object (the unmoved mover himself) which is not *composite* (σύνθετον)

> A further question is left—whether the object of the thought is **composite** [σύνθετον], for if it were, thought would change in passing from **part** to **part** of the whole We answer that **everything which does not have matter is indivisible** [34] As human thought, or rather the thought of composite objects, is in a certain period of time (for it does not possess the good at this moment or that, but its best, being something *different* from it, is attained only in a whole period of time), so throughout eternity is the thought which has *itself* for its object (*Met* Λ 9, 1075a5–10, my boldface, Ross's italics)

As this passage illustrates, Aristotle's rationale for viewing the unmoved mover as incomposite is quite general and can thus be read as applying to *all* form form is incomposite and hence indivisible and without parts, he states, precisely because it is completely free of matter, that is, pure actuality [35] According to this strand within Aristotle's thought, then, it is a thing's association with matter which leads to its mereological complexity

On the face of it, Aristotle's discussion of the form of *nondivine* living things, that is, the soul, in *De Anima*, seems to conflict with the strand within Aristotle's thought just isolated, since he there appears to speak quite overtly of the soul as having *parts*. For example, the human soul is said to have as parts the faculties responsible for nourishment and growth, locomotion, perception and thought. However, when we look more closely at the text, we see that, in contexts in which Aristotle is being careful about his choice of words, he in fact expresses some uneasiness concerning the practice of referring to these "powers," "potentialities," or "capacities" (δυνάμεις) of the human body as *parts* of the soul in the strict mereological sense. For example, in *DA* III 9–10, Aristotle explicitly worries that, if the faculties really were to be viewed as genuine parts, the soul would, as a result of this view, be divided into an absurdly large number of such parts:

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[34] I have here changed Ross's "everything which has not matter" to the less archaic sounding, "everything which does not have matter "

[35] The current reasoning does not apply to mathematical objects which, according to Aristotle, have a kind of matter (namely, "intelligible matter") Similar passages to the effect that entities without matter have their unity in an underived primitive manner can also be found in *Met* H 6, though there is some dispute among the commentators as to the exact nature of the entities Aristotle had in mind in this context (for example, form/essence versus the highest genera in the categories)

> Those who distinguish parts [μέρη] in the soul, if they distinguish and divide in accordance with differences of power [δυνάμεις], find themselves with a very large number of parts, a nutritive, a sensitive, an intellective, a deliberative, and now an appetitive part; for these are more different from one another than the faculties of desire and passion. (*DA* III 10, 433b1–4)

In fact, as the following passage from *DA* I 5 seems to indicate, one of the reasons for Aristotle's reluctance to consider the faculties of the soul as, strictly speaking, parts of it, is precisely his sensitivity to the potential regress that would result from a conception of the soul as itself mereologically complex:

> Some hold that the soul is divisible [μεριστήν], and that we think with one part and desire with another. If, then, its nature admits of its being divided, what can it be that holds the parts together? Surely not the body; on the contrary it seems rather to be the soul that holds the body together; at any rate when the soul departs the body disintegrates and decays. If, then, there is something else which makes the soul one, this would have the best right to the name of soul, and we shall have to repeat for it the question: Is *it* one or multipartite? If it is one, why not at once admit that *the soul* is one? If it has parts, once more the question must be put: What holds *its* parts together, and so *ad infinitum* (*DA* I 5, 411b5–14)?

This passage suggests that, despite Aristotle's loose way of speaking of powers as parts, he in fact takes it to be the best remedy against a potential regress of principles of unity simply to let the buck stop with form: if forms are mereologically simple, then the unity of the soul needs no further account, since it has no parts relative to any conceivable measure.[36]

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[36] Though this reading goes against the tenor of this passage, Aristotle could also be taken as suggesting another option: that the soul is mereologically complex and in fact

According to the reading I have suggested in the preceeding paragraphs, then, both Aristotle's discussion of the unmoved mover in *Met* Λ as well as, despite first appearances, his discussion of the soul in *De Anima* confirm the suspicion that form, in contexts in which it is *not* thought of as the object represented in a definition, plays the role of the ultimate mereological atom within Aristotle's system, it is precisely because of its mereological and ontological simplicity that Aristotle thinks form can perform the crucial task of putting to rest the potential regress consisting in a never-ending demand for further principles of unity [37]

III UNITY AND INDIVISIBILITY

Aristotle in some ways backs himself into a corner by accepting certain assumptions which he thinks are needed to solve the Problem of the One and the Many, first and foremost among them the following two (i) the conceptual connection he sets up right from the start between *unity* and *indivisibility* into parts, and (ii) the principle

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contains a part which holds together the remaining parts At least in the case of the human soul, the most plausible candidate for a part of the soul which could simultaneously act as the principle of unity holding together the remainder of the parts is of course the active intellect, which is discussed primarily in *DA* III 5 In a sense, this possibility merely brings us back to the preceeding remarks concerning the incomposite nature of the unmoved mover, as described in *Met* Λ for Aristotle conceives of the active intellect as that faculty within us by means of which we most resemble God, though with some hesitation, he sometimes speaks of it as possibly separable from the body (and hence completely free of any association with matter) and is similarly concerned to establish (for example, in *DA* III 6) that this faculty and its activity are not divisible into parts This second option is thus not incompatible with my reading, but merely adds another layer of complexity to Aristotle's conception of matter/form-compounds for it now turns out that those forms, which hold together the parts of a matter/form-compound, are themselves hylomorphically complex and contain within themselves another principle of unity, a higher-order form, so to speak, which holds together the parts of the lower-level form The search for the ultimate mereological atom, then, according to this second reading, does not end until we reach something which is completely free of any association with matter, namely, the highest-level form or principle of unity Since it is not obvious, however, how we would account for the unity of form in the case of plants and nonhuman animals, on this reading (since they lack a God-like component in their souls), Aristotle might in fact be better served by taking the first route and letting the buck simply stop with form at the first level

[37] And even when Aristotle speaks of form in the sense of definition or formula of the essence, he appears to be driven by his general views on composition to identify even in this case a component within the definition that is aligned with *matter* (the genus) and a component that is aligned with *form* (the differentiae), or at least we see him going through great contortions (for example, in *Met* Z 10–12) in his attempt to come up with a satisfying account of the apparently composite, yet unified, nature of form, when understood in the manner of definition This would suggest that Aristotle in general adopts a hylomorphic approach to composition, even when the composite entity in question is not material in any ordinary sense

that a mereologically complex object must always derive its unity from some *source*, whose own unity in turn cannot be open to further question These two assumptions together threaten to lead to a never-ending demand for further principles of unity and in the end launch Aristotle on his search for the ultimate mereological atom for only something that is indivisible relative to every conceivable measure, by claiming to have its unity in a primitive and underived manner, could ever put to rest the potential regress to which (i) and (ii) appear to give rise I argued in the last section that, with some ambivalence, Aristotle takes form to play the role of the ultimate mereological atom within his system, on the basis of the general principle that things that have no association with matter (and hence are pure actuality) are not divisible into parts by any measure, though this strategy conflicts with other central metaphysical commitments that are dear to him, most notably the close association between form and definition, the latter of which is generally assumed by Aristotle to be mereologically complex

In response to the difficulties to which the Aristotelian account gives rise, I recommend that we ask ourselves, first, whether the assumptions in (i) and (ii) are even particularly plausible and, secondly, whether they are in fact necessary for a solution to the Problem of the One and the Many, once we realize that neither is the case, we will see that the Problem of the One and the Many does not require the drastic measures to which Aristotle finds himself driven Consider thus, first, the conceptual connection Aristotle sets up between the notions of unity and indivisibility according to this conception of unity, something's being *one* according to some measure (that is, its being one *something-or-other*, where the concept used to fill the slot marked by the phrase 'something-or-other' supplies the measure in question) is taken to amount to its being not further divisible into parts according to the measure in question, in fact, the lack of divisibility seems to be identified by Aristotle as the reason for the object's status as a unified thing with respect to the measure at hand

And while oneness and indivisibility may line up in this way in very many cases, Aristotle's close conceptual connection between these two notions in fact runs into trouble when applied across the board [38]

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[38] Examples of the sort that follow are also used in my "Isolation and Non-Arbitrary Division Frege's Two Criteria for Counting," *Synthese*, cxii, 3 (1997) 403–30, and "The Semantics of Mass-Predicates," *Noûs*, xxxiii, 1 (1999) 46–91, to make related points as they arise in the context of the so-called "mass/count-distinction," a linguistic distinction marked by a wide range of languages which represents the difference between what we *count* and what we merely *measure* Count-nouns are almost universally regarded as being semantically different from mass-nouns in that their referents are indivisible into further parts by means of the measure supplied by the count-noun (or

For it is not difficult to think of cases in which it is perfectly natural to call something *a* or *one* something-or-other, even when the object in question is further divisible into objects of the same kind for example, a building may be composed of proper parts which are themselves buildings, a particular pattern may be composed of proper parts which are themselves patterns (in fact, the objects in question may even be instances of the very *same* pattern, only on a smaller scale), many strings in the alphabet, {'a', 'b'}, are composed of proper parts which are themselves also strings in the same alphabet, a journey may be composed of smaller journeys, and so on [39] In each case, the fact that an object is further divisible into proper parts which satisfy the same concept is no obstacle to its counting as *one* something-or-other, relative to the measure in question Given the naturalness and intelligibility of cases of this sort, the presupposed connection between unity and indivisibility can at most be regarded as a useful rule of thumb, but not as a conceptual truth which correctly describes the domain of objects to which our practices of counting and individuation are directed

Consider now the second crucial assumption driving the Aristotelian response to the Problem of the One and the Many, namely, the principle that a mereologically complex object must always derive its unity from some *source*, whose own unity in turn cannot be open to further question [40] Again, there is at least in principle no reason why something that in itself has a relatively low degree of unity should not be able, when coming into contact with objects of the right kind, to

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the concept associated with the noun) thus, the noun, 'human-being', for example, which is standardly used as a count-noun, applies to objects each of which is *a* or *one* human being, and, as in Aristotle's case, something's being *a* or *one* human being is taken to coincide with its being not further divisible into parts relative to the measure, 'human being' The semantic properties in question are sometimes called "atomicity" (since the extension of a count noun is thought to consist of mereological atoms relative to the term in question) and "nondistributivity" (since it is not the case that *every* part of something that satisfies a count-noun itself also satisfies the noun in question, that is, the noun does not *distribute* over all of the proper parts of that to which it applies) For reasons similar to those brought up in the main text, I do not believe that properties like atomicity and distributivity can be used to mark the semantic contrast between mass- and count-nouns, see my "Isolation and Non-Arbitrary Division," "The Semantics of Mass-Predicates," as well as "Nouns, Mass and Count," in Donald M Borchert, ed , *Encyclopedia of Philosophy*, 2nd ed (Detroit MacMillan Reference, 2006), for further discussion

[39] The example, strings in the alphabet, {'a', 'b'}, comes from Richard Cartwright, "Notes on Aquinas" (unpublished manuscript, 1994), the case of journeys was brought to my attention by Andrew Loxley; thanks also to Leopold Stubenberg for helpful discussion in connection with the issues brought up in this and the next few paragraphs

[40] Halper cites in this connection the following passage from *Met* α, as suggesting a general principle from which it follows that the cause of unity must be unified to a *higher*

unify these objects to a higher degree than the degree of unity possessed either by the unifier or by the participating objects prior to this association For example, imagine a particular kind of glue which is by itself chemically quite unstable (that is, in the sense of having a high propensity to disintegrate into its components), except when it is brought into contact with particular substances, such as wood or paper, in which case the glue and these substances together result in something whose parts hang together much more tightly than did the parts of either object taken by itself

Thus, it seems that neither of Aristotle's two central assumptions represents a conceptual truth concerning the connection between the notions of unity and indivisibility into parts Rather, an object apparently can be *one* something-or-other, relative to some measure, even when it is further divisible into proper parts by the same measure, moreover, there is no reason in principle to expect that the parts of a mereologically complex object must be held together by a principle of unity which possesses a higher degree of unity than the degree of unity it contributes to the whole it unifies Given these results, then, we ought, first, to separate the notion of oneness or unity from that of indivisibility, and we ought, second, to abandon the expectation that principles of unity must themselves either be mereologically simple relative to any conceivable measure or, more generally, that they be themselves highly unified

Once we realize that Aristotle's two crucial assumptions are in fact neither particularly plausible nor necessary for the solution of the Problem of the One and the Many, other strategies suggest themselves by means of which we may address the challenge posed by this problem, namely, to say how an object can be *one* despite the fact that

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degree than the objects it unifies, see Edward Halper, *One and Many in Aristotle's Metaphysics The Central Books* (Columbus Ohio State UP, 1989), p 154

> Now we do not know a truth without its cause, and a thing has a quality in a higher degree than other things if in virtue of it the similar quality belongs to the other things (e g fire is the hottest of things, for it is the cause of the heat of all other things), so that that which causes derivative truths to be true is most true (*Met.* α 1, 993b24–26)

This assumption incidentally is also reminiscent of a similar principle employed in Descartes' cosmological argument for the existence of God, according to which that which causes other objects to have a certain quality must always itself exhibit the quality in question to a higher degree than the objects which derive this quality from it, similar examples are used by Descartes to illustrate the principle in question (for example, fire must be hotter than the objects which are heated by it, and so on) Also highly relevant in this context is Haslanger's discussion of extrinsic and intrinsic principles or sources of unity in her "Parts and Compounds," pp 137ff it has *many* parts. Here, in the broadest of strokes, is what I take to be a plausible response to the Problem of the One and the Many along generally Aristotelian lines. What does it take, for example, for a particular specimen of the kind, *H_2O-molecule*, to be unified? Following Aristotle's relativized conception of unity, this question rephrases into the question of what it takes for something to be unified with respect to the measure, 'H_2O-molecule', or, equivalently, what it takes for something to be *one* H_2O-molecule, and chemistry tells us how to answer this latter question. Specimens of the kind, *H_2O-molecule*, come into existence when two hydrogen-atoms and one oxygen-atom enter into the particular configuration of chemical bonding objects of this kind are *unified* in the sense that they are *one* specimen of the kind in question, that is, *one* relative to the measure, 'H_2O-molecule', their material components hang together to the degree that hydrogen- and oxygen-atoms which enter into this particular configuration of chemical bonding can be expected to do so. That an object which counts as *one* or *unified* relative to the measure, 'H_2O-molecule', has parts at all, that is, is divisible relative to some measures, poses no threat to its status as a particular specimen of the kind in question rather, given what we know about the chemical composition of H_2O-molecules, nothing *could* be one specimen of this kind or unified relative to this particular measure without having as parts at least two hydrogen-atoms and one oxygen-atom, there is nothing further that the mereologist proper or the ontologist at large can add to what the scientist has already told us about the chemical composition of objects of this kind.[41] The mereologist *can*, however, be held responsible for the task of devising a theory of parthood and composition which is responsive to the fact that there can be no H_2O-molecule, unless a particular plurality of material components satisfies certain formal requirements associated with this kind of whole, such as those concerning number, variety and configuration. And we ought to follow Aristotle in thinking that such a theory of parthood and composition takes the form of a mereological hylomorphism.

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[41] Why, for example, are there H_2O-molecules? Presumably, the nonphilosopher's answer to this question would make reference to the laws of nature, the Big Bang (or whatever other initial state of the universe turns out to be accepted by our best scientific theory) and the complex intervening processes that lead to the formation of molecules. An answer of this kind is directed to the question of what conditions were required to obtain to make the formation of such objects possible and to sustain their continued existence. Neither the mereologist nor the ontologist at large can be expected to have anything of interest to contribute to this question.

OCKHAM'S METAPHYSICS OF PARTS

Much recent work on parts and wholes has been stimulated by two broad metaphysical issues about identity One of these involves a family of puzzles about how something which is constituted is related to what it is constituted by One of these puzzles is what has come to be called the problem of *material constitution*, it is classically illustrated by the example of a statue and the bronze or clay or marble out of which it is made, and the question whether these are the same thing [1] The second issue involves a family of puzzles about how a thing is related to the various collections of parts into which it may be divided The classic puzzle of this form is the one Diogenes Laertius says Chrysippus attributed to Epicharmus and which became known as the "Growing Paradox"—the puzzle of how a thing can be the same over time if it consists of different parts over time A closely related puzzle is the one Peter Unger has called the "Problem of the Many" and others call the "Paradox of the 1001 Cats"—after Peter Geach, who introduced it as a problem about his cat, Tibbles, who has a great many proper parts each of which is not identical to Tibbles but differs only in ways (like lacking a single one of Tibbles's hairs) which are not essential to being a cat at all It seems hard to deny that such a part would be a cat were Tibbles's offending hair removed Why then is it not already a cat?[2]

Both broad metaphysical issues are ancient and both have (almost) continuous medieval histories [3] Little of those histories has yet been written In what follows I focus on one medieval thinker, William

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[1] Another is the question of whether there can be "innocent" alternatives to set theory, that is, theories which allow one to collect the putative members of a set without committing oneself to the collection being some thing other than the items collected

[2] For the Growing Paradox, see David Sedley, "The Stoic Criterion of Identity," *Phronesis*, xxvii (1982) 255–75 Unger's discussion is to be found in his "The Problem of the Many," *Midwest Studies in Philosophy*, v (1980) 411–67 Geach's is in his *Reference and Generality* (Ithaca Cornell, 1980, 3rd edition), section 110, pp 215ff

[3] Even the examples are widely discussed in the Middle Ages The example of the statue and the stone of which it is made is Abelard's central example, see, for example, *Logica Ingredientibus* I, 79, 5–17, the example of the statue and the bronze of which it is made is Aristotle's and is regularly discussed in connection with commentary on *Metaphysics* Z, see, for example, Averroes, *In Metaphysicam Aristotelis*, t c 61 [*ad Met* VII, 17, 1041b4–33] Abelard and his followers, the *Nominales*, were notorious for their discussion of the sophism "Nothing Grows", and Abelard's discussion of the problem of the Many Men (as Andrew Arlig has called it—see his "Medieval Mereology," *Stanford Encyclopedia of Philosophy* (http //plato stanford edu/entries/mereology-medieval (accessed

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of Ockham, whose work has been enough studied that we may make a beginning on understanding his thought on these matters Ockham is (and in the later Middle Ages was) thought of as part of a tradition—that of medieval Nominalism—and is engaged with other major thinkers who reflect alternative approaches, so one can hope that such a restricted focus will nonetheless shed light elsewhere

The Middle Ages inherited from antiquity by way of Boethius a rather complex and motley taxonomy of concepts of part and whole In *De Divisione,* for example, Boethius begins by distinguishing continuous wholes (such as a body or a line), wholes that are not continuous (like a crowd or an army), universal wholes (like human or horse), and wholes whose parts are powers (like the soul) [4] He points out that sometimes a whole can be divided into parts homogeneous with it and sometimes not, and he goes on to distinguish the division of a whole into matter and form as a special case Boethius's motley provided fertile ground for a research program, and work on parts and wholes forms part of medieval logic and metaphysics from its very beginning

The sheer diversity of the senses of 'whole' and 'part' which Boethius distinguishes posed a problem for medieval thinkers who were in the first instance teachers and had to organize material in a way suitable for teaching Boethius's motley came to be organized in various ways [5] I am going to leave all of these issues aside in what follows My focus will be on three issues (1) how what Ockham (and many of his contemporaries) call the *essential parts* of substances, that is, those which enter into an adequate account of what a given substance is, are related to the substances of which they are parts, (2) how

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2006)) is a classic See Christopher J Martin, "The Logic of Growth Twelfth-Century Nominalists and the Development of Theories of the Incarnation," *Medieval Philosophy and Theology,* vii (1998) 1–15 Geach himself credits the early thirteenth-century logician William of Sherwood with inspiring his example of Tibbles Geach leaves the exact source in Sherwood as an exercise for the reader I hypothesize that it is the Abelardian example which occurs as a sophism in William of Sherwood's treatise on syncategoremata, see J R. O'Donnell, ed , "The Syncategoremata of William of Sherwood," *Medieval Studies,* iii (1941) 46–93, and see William of Sherwood, *Treatise on Syncategorematic Words,* translated by Norman Kretzmann (Minneapolis Minnesota UP, 1968), p 60

[4] Cf Boethius, *On Division,* translated in Kretzmann and Eleonore Stump, eds , *The Cambridge Translations of Medieval Philosophical Texts,* Volume 1 (New York Cambridge, 1988), pp 1–11

[5] The use of the concepts of part and whole in the analysis of the distinction between universal and particular sentences is both puzzling and interesting, the distinction of the soul into powers as parts is mysterious After Aristotle's nonlogical work with its own typology of parts and wholes became available in the Latin world, there was considerable effort expended on bringing order into the motley of senses

what they call the *integral parts* of a material object, that is, the parts into which it can be physically divided, are related to the whole object, and (3) how issues about sameness and difference of parts over time interact with issues about sameness and differences of wholes over time

Most of the medieval history of these topics is still *terra incognita* What is already clear is that early in the twelfth century they were among the hottest of philosophical subjects and that a wide variety of positions on them had already been articulated and debated These debates were carried on in innocence of Aristotle's *Physics, De Generatione et Corruptione, Meteorology,* and *Metaphysics,* and so in innocence of the details of Aristotle's thinking about matter and form, but they reflect a considerable knowledge of late ancient Latin writers and from them inherit information not only about the thought of Aristotle and Plato but also about Stoic, Epicurean, Galenic, and other pictures Details are often missing, but the main lines of a great many ancient positions seem to be at work in the twelfth-century debates

Boethius's own texts and those he translated formed the core of the curriculum of twelfth-century education, and Boethius's legacy on parts and wholes formed one of the cornerstones of twelfth-century thought We can see in the work of thinkers like Peter Abelard and Gilbert of Poitiers, and in work which purports to present the thought of Joscelin of Soissons and Walter of Mortagne, how it led to the development of very rich theories of part-whole relations which insisted on the independence, and in some cases, the priority, of parts with respect to the wholes of which they are parts [6] These theories were driven to the background by the arrival of Aristotle's nonlogical work and the role it came to play in the curricula of the universities, but they did not disappear Fourteenth-century theorists can often profitably be seen as attempting to revive twelfth-century insights in the newer Aristotelian context—and so it is with issues of parts and wholes

I SUBSTANCES AND THEIR ESSENTIAL PARTS

One central question in this whole tradition is whether a whole is identical to all its parts taken together This is not the same question as whether a whole is identical to all its integral parts in the sense outlined above The tradition typically has it that some things (substances at least) are composed (in one sense) of matter and form—and if one thinks (with Boethius) that the form can be treated as a part, then quite clearly the whole is not identical with just the integral parts Of course, for those items (if any) where no substantial form is present (heaps of stones, for example) one might wonder whether they just are their integral parts, or whether they are things distinct from the parts taken together If one thinks they are items distinct from their parts taken together, one might also wonder whether there is some other item, a "form of the whole," in virtue of which they are distinct from those parts, and if there is such an item, how it avoids being just another part But even in the case of substances one might wonder whether the substance just is its constituent matter and form taken together, or whether it is another distinct thing, and if so, whether it involves something else—something which corresponds to the combination of the matter and the form

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[6] There is excellent recent work on these issues, see especially A Arlig, *A Study in Early Medieval Mereology Boethius, Abelard, and Pseudo-Joscelin* (unpublished Ph D Dissertation, The Ohio State University, 2005), and the references therein

This last question—whether a substance consisted of anything besides its matter and form—was hotly debated in the early fourteenth century Discussion of it emerged naturally out of the considerable effort required to assimilate Aristotle's *Metaphysics*, Books VII and VIII, texts which by mid-century formed part of advanced courses in the Arts Faculties Aristotle there considers the question whether substance is matter, is form, or is a composite of the two This last position, that substance is what is composed of matter and form, can be understood in various ways, depending on how one understands composition and in particular whether one understands composition as inevitably giving rise to something other than the items composed Debate about these issues was further fueled by debate about the so-called unity of substantial forms—the question whether a substance could be composed of items which had a claim to themselves be substances

On these issues Albertus Magnus and his protégé Thomas Aquinas had taken a radical stand They insisted that in a composite substance there were no parts, integral or essential, which were ontologically prior to the substance A composite substance, an animal, for example, comes to be out of other substances, but only the prime matter of that out of which it comes to be remains in the new substance, and that prime matter has no existence of its own Since individuation of the form of the new substance is through its union with that matter, the individual form cannot pre-exist the composite either Thus there is nothing "in" the individual composite substance which pre-exists it either temporally or by nature[7]

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[7] Aquinas does think that the specific form—the form of human being—is in some sense naturally or explanatorily prior to the composite, but it is not in any sense a metaphysical component of the composite The individualized form, the particular

Moreover, while a composite substance always has integral parts—hands, blood vessels, and the like—these parts are themselves ontologically dependent on the substance a severed hand is only homonymously a hand, and once severed, a hand is no longer a thing of the kind it was—indeed is likely no longer one thing at all The single substantial form of the animal so "masters" the matter that all of the parts and properties of the animal are due to either the form or due to subsequent accidental forms Aquinas, for example, insists that an animal body does not even contain any of the elements The animal body exhibits features which one might (say) attribute to its being 95% water, but on Aquinas's view there is no water in it Instead there is "flesh and bones" which has acquired in the process of being made out of water some of the powers and features water usually has Albert and Aquinas of course do admit that the individual human soul (which is the only substantial form present on their view) can exist apart from matter, and does so naturally after death, but Aquinas, for example, insists that when it does so it has the same *esse*, the same act of existence, that the composite used to have Hence, while no longer strictly a human being, it is what used to be that human being[8]

This position is familiar to us because it is now also a common interpretation of Aristotle's views on the issue According to this interpretation one important function substantial forms serve for Aristotle is precisely that of accounting for the unity of a substance and the difference between a material substance and the sum of its material parts Substantial forms are Aristotle's solution to such Platonic problems as the problem raised in the *Theaetetus* of how a syllable can be composed of letters given that those letters can all exist when the syllable does not They solve these problems by causing matter to be so unified that, strictly speaking, none of the materials that went into generating the composite substance remain as those materials

Though familiar to us, this interpretation of Aristotle was not the common understanding of the thirteenth-century Latin masters Much more familiar was the thought that at the very least God could make matter and make individual human souls prior to combining

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human soul for example, could not have come into existence (apparently even by divine power) except by the composite coming to be Hence it is not naturally or explanatorily prior to the composite See *Summa Theologiae* I, q 90 art 4, ad 1

[8] Thus Aquinas is committed to the position that the body of Christ in the tomb was not univocally a human body and its eye not univocally a human eye See Aquinas Quodlibet III q 2 a 2

the two This required that the essential parts of a composite substance have some ontological independence, and it raised the question of exactly what was the relation between the composite and such independent parts [9]

The simplest proposal, I suppose, is that the relation is identity—a composite substance just is one or more of its essential parts Perhaps we could put the point more familiarly as that a composite substance just is its *essence* In *Metaphysics* Z, Aristotle canvasses whether we should identify substance with the matter, the form, or the composite He apparently concludes that we should not identify it with the matter alone, but his text is notoriously unclear about whether we should identify substance with the form or with the composite—and even less clear about what it would be to identify the substance with the composite [10] Thirteenth-century writers took a wide variety of positions about what Aristotle had in mind here and about whether he was right Aquinas' position formed one extreme

One focus of medieval discussion of this was on generation When a typical substance, a nonhuman animal say, is generated, what exactly comes to be? Aquinas's radical answer was that everything actual involved comes to be The individual form of the animal comes to be, the body of the animal comes to be, and the animal comes to be The prime matter involved does not come to be, but it is not actually anything—it is "pure potentiality"[11] This conception of matter was untraditional in the Latin West and it did not win wide acceptance Twelfth-century writers like Abelard had typically taken it as obvious that there was matter which was something actual apart from whatever forms might inform it, and, despite the efforts of Albert, Thomas, and their followers, this idea never lost currency It was given fresh life at the beginning of the fourteenth century by Duns Scotus who argued that if prime matter was to have modal properties strictly speaking (so that it could be actually this on one occasion and actually that on another) it had to actually exist [12]

Aquinas's proposal has the consequence that it is impossible that that the matter and the form of a composite exist separately In the case of the substantial form which is a human soul, he thinks that it can exist apart from the matter of the human being, but that this matter cannot exist apart from the human being without being the matter of something else In the case of a nonhuman animal neither the soul nor the matter can exist separately Scotus and most of his contemporaries thought that at least by divine power the soul (or souls) of a nonhuman animal and the matter which makes up the body of that animal on a given occasion can exist separately [13]

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[9] In his *Lectura Secunda*, prol q 1, Adam Wodeham outlines a discussion of these issues which involves first William of Ware, then John Duns Scotus, then William Ockham, and finally himself See Richard Cross, "Ockham on Part and Whole," *Vivarium*, XXXVII (1999) 143–67

[10] A magisterial and still very useful discussion of this issue is to be found in Joseph Owens's *The Doctrine of Being in the Metaphysics of Aristotle* (Toronto Pontifical Institute of Medieval Studies, 1951)

[11] Aquinas, Quodlibet III, q 1 a 1

[12] For Scotus's position and arguments here, see Cross, *The Physics of Duns Scotus* (New York Oxford, 1998), chapter 2, and the references therein

Scotus's answer, and the answer of many of his near contemporaries, is that when the animal exists there is a "form of the whole" (*forma totius*), which is not present when the essential parts of the animal exist separately In mid-thirteenth-century writers like Aquinas and Bonaventure this form of the whole is identified, in the case of a substance, with its essence Bonaventure puts it this way

> It should be said that the species expresses a form, not any one whatever, but a form of the whole—that is a form embracing the whole *esse* According to constitution 'human' (*homo*) expresses a form which involves soul and body and which results from the conjunction of soul with body For soul and body go together in constituting one essence ”[14]

The form of the whole is here identified with the essence which accounts for the actuality of the substance in question Everything which that substance is, is expressed by the essence/form of the whole, and so the form of the whole is not a part of the substance The relation between a substance and its essence is not, for Bonaventure or Aquinas, a matter of being related as whole to part

Duns Scotus takes over this understanding of the form of the whole as essence On Scotus's understanding, as Richard Cross has shown, the individual composite substance, precisely because it has an essence/form of the whole, is a thing distinct from any of its essential parts [15] Thus, for Scotus, the process of essential composition is not mereologically innocent. Put essential parts together and something is generated, some new *thing* comes into existence.

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[13] Whether an animal had one soul (that is, one substantial form) which accounted for all its nonaccidental properties or instead had two or more substantial forms hierarchically organized was hotly debated in the period The issue again has to do with the unity of the animal See the classic study by Roberto Zavalloni, *Richard de Mediavilla et la controverse sur la pluralité des formes* (Louvain Éditions de l'Institut Supérieur de Philosophie, 1951)

[14] Bonaventura, II Sent d 2 art 2 q 3 resp This passage was brought to my attention by Peter King's excellent article, "Bonaventure's Theory of Individuation," in Jorge J E Gracia, ed , *Individuation and Scholasticism* (Albany SUNY, 1994), pp 141–72 My translation is based on King's translation there

[15] Cross argues this with care and flair in chapter 5 of his *The Physics of Duns Scotus* See also his closely related paper, "Duns Scotus' Anti-Reductionist Account of Material Substance," *Vivarium*, xxxiii (1995) 137–70

This is precisely what Ockham and Jean Buridan deny.

Ockham's ontology includes individual substantial forms, individual accidental forms picked out by absolute terms in two species of the category of quality, and individual *matters*. God, angels, and human intellectual souls are all individual substantial forms. Each of your thoughts, the instance(s) of color on your cup, and the instance(s) of heat in your hand are all individual accidental forms. The matter of which your cup is composed is a matter. Ockham also speaks freely about individual composites of an individual form and an individual matter. George Jr., my son's pet Giant African millipede, is such a composite. Individual substantial forms, individual accidental forms, matters, and individual composite substances are all beings (*entia*). There are lots of significative terms other than the proper names of these beings—but they do not signify anything other than these beings because there is nothing else to signify.

Ockham recognizes in beings just essential and integral parts. Some substances—God, angels, and human intellectual souls—have no parts at all, neither essential nor integral. This may be true for some accidental forms as well (perhaps some thoughts are like this, for example), but all matters, many substantial forms, many accidental forms, and all composite substances have integral parts. Only composite substances have essential parts—they are composed essentially of a matter and a form.

While Ockham thinks that substances are not identical with their integral parts, he does think that they are identical with both of their essential parts (that is, with their form and their matter), taken together. Here he explicitly sets his face against the position he finds in Duns Scotus—that there is a form of the whole which accounts for a composite substance being a distinct thing from its essential parts taken severally or jointly. As Ockham understands Scotus, this form of the whole is not just the composite substance itself but an item which accounts for the distinctness of the composite from its essential parts. Ockham is right to understand Scotus (and indeed the whole tradition of appeal to the form of the whole) in this way. Scotus is concerned to show that (for example) humanity is not the same thing as human form or human flesh and bones taken severally or jointly. It is a distinct metaphysical item. Scotus thinks of this item, the human essence, as being individuated by the presence of another item, something "on the side of the form" as he sometimes puts it, which some of his followers call a *haecceity*. Thus the distinctness of a composite substance from its essential parts is fixed independently of its indviduation. Hence we should not simply identify the so-called form of the whole with the individual composite substance. There is a sense in which it is naturally prior to that substance—though it is not really but only formally distinct from it. There is then also a sense in which Scotus's appeal to the form of the whole is a sleight of hand. To identify simply the form of the whole with the individual composite would be, by Ockham's lights, to beg the question against the position that the composite just is the essential parts taken jointly. To suggest that the supposed form of the whole is another part of the composite would be to invite the question of whether the composite is distinct from *all* its essential parts taken jointly. Scotus attempts to slip between the horns by introducing the unified essence as a new metaphysical item distinct from both the composite substance and its parts.

Ockham will have no truck with any of this. Like Buridan he thinks that the essence of Socrates just is Socrates, and he recognizes no distinctions in nature other than real distinctions. Hence, on his view, the form of the whole would have to be either the composite itself or one of its essential parts. To posit another essential part besides substantial form(s) and matter seems to Ockham to multiply entities to no purpose, and simply to claim that the composite must be a thing distinct from its essential parts taken jointly is to beg the question.

The crucial question for Ockham is how we are to understand the 'both' or the 'taken together' or the 'jointly' in the formula that a composite substance is both its essential parts taken together or jointly. In *Quaestiones Variae*, q. vi art. ii (*Opera Theologica* VIII, pp. 207–19), Ockham treats this issue in the course of analyzing the sentence "Both parts terminate the generation" (where the parts in question are the form and matter, and the generation is the production of the composite substance). Ockham takes it as obvious that the production of a material substance is not (just) the production of the matter or the form. Since he thinks there is nothing to the composite substance other than its matter and form, of what is it true that it has been produced? His suggestion is that in the normal case *both* the matter and the form have been produced. He claims that unlike 'either one of' (*uterque*), 'both' (*ambae*) has a collective reading just as does 'all' (*omnes*) in "All the apostles are twelve." Add an apostle to the earlier eleven and it is now true that all the apostles are twelve. We cannot, says Ockham, infer "This apostle is twelve" from "All the apostles are twelve" and "This is an apostle", and so being twelve is not the property of any single apostle, nor need we introduce a new entity—the dozen of apostles. Rather we are to understand the 'all' collectively and allow that predication can be plural.[16] What is distinctive and interesting about Ockham's thinking at this point is that, while he is prepared to admit that there are predicates which can be applied to analogues of mereological sums and not to their parts, he also insists that, once we understand the resources of plural quantification, we need not take this admission to commit us ontologically to sums over and above the items summed.

Ockham holds the interesting view that for a composite substance to be generated it is necessary that one of its essential parts be generated, but that for a composite substance which does not exist at *t* to exist at *t*+ it is not required that it be generated. It is thus that he replies to Scotus's challenge to explain on a view like his what has happened when essential parts which exist already are united and as a result a composite substance that did not exist now does exist. The case both have in mind is that of Christ in the tomb. Ockham's view, in *Quaestiones Variae*, q. vi art. ii, is that during the three days between Christ's death and resurrection his human form and the matter for it each exist, but that the composite which is Christ's human nature does not exist. Come the resurrection that composite comes into existence again but it is not generated because no new thing is made. Instead what happens is that a condition preventing the form and matter from being united is destroyed and so they are reunited.

Let 'Socrates' be a name for the individual composite substance, the matter/form composite, which so impressed Plato. One consequence of the picture just sketched is that, contrary to what Ockham often suggests (but never so far as I can tell actually claims), 'Socrates' is not an absolute term in Ockham's sense—that is a term which simply picks out one or more objects. The reason is that *what* 'Socrates' picks out, the particular chunk of matter, the particular sensitive form, and the particular intellectual soul which are his essential parts, are only picked out by the term if a further condition is met—if they exist not separated from one another. This is a contingent condition (as the example of the body of Christ in the tomb shows) and so 'Socrates' is a connotative term—that is a term which picks a thing out only as long as it meets a certain condition.[17] If composite substances are in Ockham's ontology then that ontology cannot be limned with absolute terms alone

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[16] The use of plural quantification to avoid reification of wholes seems to have been a common feature of fourteenth-century nominalist thought. For Buridan, see his *Quaestiones in Porphyrii Isagogen* q. 4, in R. Tatarzynski, "Jan Buridan Kommentarz do Isagogi Porfiriusza," *Przeglad Tomistyczny*, ii (1986) 111–95. (I owe this reference to Gyula Klima.) See also Stephen Read, "Thomas of Cleves and Collective Supposition," *Vivarium*, xxix (1991) 50–84.

[17] On Ockham's view, for example, the connotative term 'pale' picks out the things which are pale but only as long as they are appropriately related to an instance of the quality, paleness.

II WHOLES AND THEIR INTEGRAL PARTS

Animals are the most natural candidates for Aristotelian substances and plants are plausible candidates Artifacts, armies, minerals, crystals, stones, and pieces of wood all seem less likely candidates to be Aristotelian substances but certainly are the kinds of things that have parts What exactly is the relation between such items and their parts?

For Ockham everything which has integral parts is extended, and since everything which has essential parts is composed of matter and so has integral parts, everything which has essential parts is extended too Everything which is extended is a *quantum* (the grammatically concrete form of the Latin for quantity) Every quantum is divisible into quanta Hence, Ockham concludes, there are no indivisible matters and no indivisible composite substances

Ockham insists that if a whole exists its parts all exist This commits him to two theses One is that all of the parts into which a continuous body (a piece of wood, say) can be divided actually exist when the piece of wood does The converse, of course, is not generally true The second thesis, given that Ockham does not think that the future or the past exist as the present does, is that there are no temporal parts and so there are no *res successivae*—no such *things* as processes or events

Ockham's view is that Aristotle maintained that while craftsmen sometimes do produce something new and hence new forms—accidental or substantial—in the course of their work, there is nothing in making an artifact as such that requires this Making some artifacts, statues or houses, for instance, does not require making anything new at all but merely requires rearranging things which already exist[18] Ockham concludes from this that in some cases an artifact just is a pre-existing natural thing and in other cases it just is several pre-existing natural things For example, he says, a bath is just water in the right place at the right temperature and, perhaps, mixed with the right herbs Indeed he suggests, that nature could make a bath too—which is why we speak of natural baths Similarly, in some cases at least, a statue just is the bronze which composes it[19] Artifacts just are ways natural things are, and if we are to speak of their parts we have to speak of the natural things or the parts of those natural things

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[18] Ockham suggests that local motion by itself never produces anything new, see *Summula Philosophiae Naturalis* I cap 20, at S Brown, ed , *Opera Philosophica* VI (St Bonaventure, NY Franciscan Institute, 1984), p 210, ll 30–34

[19] See Ockham, *ibid.*, p 211, ll 70–78

What then of the integral parts of natural things? How are they related to the wholes of which they are parts? As I have already suggested, the position taken by Albert the Great and Thomas Aquinas on this issue is that substances have integral parts but that these parts depend ontologically on the wholes of which they are parts Aquinas extended this idea to conclude that the integral parts of a continuous extended whole (like a piece of wood) only existed potentially while they were part of the whole The majority opinion was other than this Ockham puts it clearly and succinctly, claiming that if we mean by "being in act" being "in rerum natura and in truth really existing outside the mind" then every part of an existing continuously extended thing is itself in act and, moreover exists of itself and does not derive its existence from the whole of which it is a part[20]

Since Ockham denies that there are any indivisibles in nature other than souls, and since he holds that continuously extended matter is infinitely divisible, he thus commits himself to what is now sometimes called "atomless gunk "

Here a problem beckons We have already seen Ockham deny that there is anything to a substance other than the form and matter which are its essential parts What now of the matter itself? If every piece of matter is nothing other than its integral parts and so depends for its existence on the existence of those parts, and if there are no ultimate integral parts, do we not have precisely the problem of which Leibniz complained—complexes without simples?

Ockham's solution begins from the premise that, just as matter and material substances have parts, so too do forms Only human souls, angels, and God are indivisible and hence "whole in whole and whole in every part" as the slogan has it Ordinary forms—elemental forms or the form of wood, for example—are extended just as the matter they inform is These forms, however, are genuine forms and so are not just the parts of which they are composed understood plurally or collectively They are dependent upon their parts in the sense that if the parts were destroyed they naturally would be destroyed, but they are items distinct from their parts and so Leibniz's regress does not bite At every level of the division of a natural continuous object we find something new—albeit not a new substance—which is in the relevant sense a simple!

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[20] Ockham does nonetheless deny that a piece of wood is made up of infinitely many other substances His thought here is that an integral part of a substance, while it is in act in the sense that it exists in the world, is not in act in another sense which sense requires precisely that it not be part of anything else

This of course commits Ockham to the conclusion that in any continuum there are actually infinitely many parts and indeed infinitely many nonoverlapping parts He happily accepts this [21]

III IDENTITY AND THE GROWING PARADOX

There is no simple story to be told about theories of identity during the Middle ages 'Idemptitas' itself is a neologism formed from the common Latin word 'idem' meaning 'same', and for most medieval thinkers sameness itself is a notion dependent on a more basic notion of distinctness There are as many kinds of sameness as there are types of distinction One of the most elaborate discussions of sameness is found in Peter Abelard who in his *Theologia Christiana* distinguishes five different senses Of these the most basic is what he calls sameness in *essentia* *A* and *B* are the same in *essentia* if they have exactly the same integral parts They are distinct in *essentia* if they do not Abelard goes on to discuss numerical sameness and distinction *A* and *B* are numerically the same if they are the same in *essentia,* and if they are numerically distinct they are distinct in *essentia,* but they may be distinct in *essentia* without being numerically distinct This happens if they share some but not all of their parts Overlapping items like this cannot in general be said to be two, but they cannot be said to be one either Abelard thus resolves the Problem of the 1001 Cats by denying that there are 1001 cats There is this cat and there is that cat, but there are not two cats

Abelard's solution is heroic because it makes any sharing of parts at all a sufficient condition for denying numerical distinctness Later writers set a lower bar They suggest that there are two things just when there is a real distinction between them Where *A* and *B* are creatures they are really distinct if and only if by the power of God each can exist without the other By this criterion a whole is not a thing distinct from any parts without which it could not exist, and the parts without which it could not exist are not really distinct from it either Real distinction becomes the criterion for counting, and, since the putative cats in Geach's example are not really distinct, there is not more than one of them Of course we need another principle to determine whether the proper parts of Tibbles are cats at all, but if they are, they are not different cats

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[21] And he devotes q 71, "Utrum in continuo sint infinitae partes totaliter distinctae inter se?" of his *Quaestiones in Libros Physicorum Aristotelis* to arguing for it See *Opera Philosophica* VI, pp 595–97 Ockham does deny that there could be infinitely many bits of matter with a fixed minimum size (and so summing to an infinite size) but it is not the actual infinite as such which worries him

Twelfth-century discussions of parts and wholes were much concerned with the growing paradox. Many material things seem to be their material parts suitably arranged, and many of these things grow. It is plausible to think they grow by adding new parts. When new parts are added, however, the collection of the parts suitably arranged is not the same collection as there was before. By the transitivity of identity if the thing just was that earlier collection suitably arranged, it cannot also be the new collection suitably arranged. Hence nothing which is just the collection of its parts suitably arranged can grow.

Although the history of the transmission of philosophical thought from the mid-twelfth century into the thirteenth is hardly better understood than that of the transmission of ancient thought into the twelfth century, it seems clear that debate about how the identity of material objects is related to that of their parts never died and that the curricular focus on Aristotle's texts in the Arts Faculties of the thirteenth-century universities did not douse the discussion. The issues were taken up in the logic textbooks of the early thirteenth century and seem to have remained a staple of discussion. Indeed one of the propositions censured in the wholesale Condemnation at Paris in 1277 was that "a human through nutrition can become another numerically and individually."[22]

On some pictures of what an Aristotelian substantial form is, such forms are tailor-made for dealing with the growing paradox. Suppose, for example, that a substantial form is not divisible into integral parts. Then one could suppose that a composite substance remains the same composite substance over time as long as the same substantial form informs matter no matter what matter it informs. Thus the growing paradox need not arise for substances with indivisible substantial forms. One need not claim that the composite substance is in every way the same as the matter changes, but one can argue that sameness of form is what is required for the numerical sameness of a substance over time.

This seems to have been the common approach to sameness for human beings during the early fourteenth century. The human soul was thought of as being wholly in every integral part of the human, and so as long as it was united to matter, any matter to which it was united was wholly that human being. Thus the human being would remain the same as long as the soul remained the same. When we turn to nonhuman substances, though, there is less agreement. Ockham and Buridan maintain that the only indivisibles in nature are human souls. All other forms, including nonhuman substantial forms, are extended and have parts outside of parts. For such forms the issue can arise of whether they remain the same over time if their parts change over time.

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[22] "Quod homo per nutritionem potest fieri alius numeraliter et individualiter." This is no. 87 in Roland Hissette's list; see his *Enquête sur les 219 articles condamnés a Paris le 7 mars 1277* (Louvain: Publications Universitaires, 1977). I owe this reference to Olaf Pluta, "Buridan's Theory of Identity," in J. M. M. H. Thijssen and Jack Zupko, eds., *The Metaphysics and Natural Philosophy of John Buridan* (Boston: Brill, 2001), pp. 49–64.

Buridan discusses this issue. His view is that there are three senses in which we may speak of a thing being numerically the same (*idem in numero*) over time—total, partial, and successive.[23] Only something which never loses or gains a part can be totally the same over time. In practice this means that the only things totally the same over time are indivisibles, and for Buridan as for Ockham the only indivisibles in nature are intellectual forms—human souls, angels, and God. Things are partially the same over time if they have a principal part which is totally the same over time. Since the only principal parts of composite substances which are totally the same over time are human intellectual souls, this means that only humans can be partially the same over time. Buridan does not tell us in any detail what is required for something to be successively the same over time. He gives the example of the River Seine which is said to be the same over a millennium because (as he says) the waters which are called by that name throughout the period succeed each other continuously (*continuate*). (The temptation to think that Buridan is here invoking spatiotemporal continuity as a criterion of identity is overwhelming.) What is clear is that Buridan does not think of successive numerical sameness as sameness proper. There is nothing which is really the same over time but rather a succession of entities, related enough so that the same name may be customarily applied.

Ockham takes up these issues in his discussion of the Resurrection, and although he does not have Buridan's typology of total, partial, and successive sameness, he comes to the same conclusions and for very similar reasons.[24] He first argues that matter is an essential part of a composite substance and hence, because a substance just is its essence, that a difference in the matter of which a composite is composed makes for a real difference in the composite Given that, as we have seen above, the essence of a composite substance just is its essential parts taken jointly, it should then come as no surprise that a difference in one of the essential parts makes for a real difference in the composite substance [25] What may be a bit more surprising is that the addition or subtraction of a bit of matter makes a numerical difference and so a real difference to the matter which composes the substance, but Ockham insists on this—arguing against those who maintain that the matter of a composite substance remains the same as long as it consists of matter of the same kind [26]

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[23] Buridan's most extensive discussion of numerical sameness over time is found in Book I q. 10 of what is believed to be the final redaction of his *Questions on the Physics of Aristotle*. This account has not been edited. There is a brief discussion in his *In Metaphysicam Aristotelis* (Paris, 1518), Book VII q. 12. Buridan's account of numerical sameness over time has been studied by Pluta in his "Buridan's Theory of Identity."

[24] Ockham, *Quaestiones in Librum Quartum Sententiarum*, q. 13, "Utrum idem homo numero resurget qui prius vixit?" in *Opera Theologica* VII, pp. 257–77.

From these premises, Ockham concludes that no composite substance remains in every way the same after growth and, that given that the resurrected body does not consist of exactly the same matter as the body before death, the resurrected human being is not in every way the same as the one who died [27] We can, however, say that the resurrected human is numerically the same as the one who died because it has as an essential part, the same intellectual soul, and that soul is simple and so remains in every way the same [28] The sameness the human has before and after growth and that the resurrected human bears to the one who died is, Ockham goes on to add, a greater unity than that which a brute animal has before and after growth precisely because the human has an essential part which remains entirely the same, whereas the brute animal has no such part—both its matter and its form change with growth by the addition of new parts

So far Ockham and Buridan are very much on the same page, but there is one step which Buridan takes at which Ockham balks Buridan allows that we can say, improperly to be sure, that a horse or a river is the same over time because of the continuity or "continuous flow" of its parts—both formal and material—and that this sort of sameness does not require that any given part remain throughout the change. Ockham does not consider the river but he does worry that if an animal at one time is wholly different in all its essential parts from an animal at another time then they cannot be the same animal, and he considers the possibility that one animal might become another without the first being corrupted or the second being generated. His response to this is to suggest that perhaps it cannot happen because for each animal there is some part (the heart, he proposes tentatively) which cannot change without the animal dying. It is a touching reminder of how far we have come from the Thomist picture of a substantial form on which all of the nonaccidental properties of a substance depend.

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[25] "Et ubi est alia materia et alia in aliquo successive est quodammodo distinctio realis inter idem et seipsum uno tempore et alio, quia aliquid est de essentia unius quod non est de essentia alterius"—Ockham IV Sent q 13 resp , *OT* VII, p 264, ll 3–7

[26] " si materia secundum eos est de essentia compositi, ad variationem materiae sequitur variatio compositi, et per consequens cum non redeat materia in resurgente, non resurget idem homo quia non est idem totum cuius non sunt eadem partes"—Ockham IV Sent q 13 ad secundam opinionem, *ibid.*, p 260, ll 2–6

[27] "Dico tunc quod sicut in augmentatione none est simpliciter omnibus modis idem individuum ante augmentationem et post, quia ubi est alia et alia materia, quae est de quidditate et essentia rei, ibi est quodammodo distinctio realis, quia aliquid est de essentia unius quod non est de essentia alterius, sicut dictum est Ita in resurrectione non erit omnibus modis idem homo ante resurrectionem et post, quia secundum omnes doctores non est simpliciter eadem materia numero in resurgente quae fuit ante resurrectionem, nec eadem forma sensitiva, si ponatur distincta ab intellectiva et extensa "—Ockham IV Sent q 13 resp , *ibid.*, p 264, ll 8–18

[28] "Tamen bene dicitur idem homo numero, quia anima intellectiva, quae est forma simplex remanet in toto et in qualibet parte" (*ibid.*, p 264, ll 19–21)

Central to both Ockham's and Buridan's pictures of the nonhuman composite substances is the thought that in them all of the essential parts, both formal and material, are extended and composed of integral parts. Both Buridan and Ockham allow that God could conserve nonhuman substantial forms without matter, so neither is prepared to reduce nonhuman substantial forms simply to the arrangement of material parts, but the priority of integral parts, both formal and material, over the wholes of which they are parts is complete.

IV. OCKHAM'S LEGACY

That the seventeenth century broke decisively (and, despite the efforts of such formidable thinkers as Leibniz, broke permanently) with the view that there were substantial forms is very widely known. What is less well understood is how the ground was prepared. My suggestion is that we should look here to the influence of the nominalist tradition and, in particular, to two theses that Buridan and Ockham shared: (1) that a whole is nothing other than its parts, and (2) that all of the parts of something actual are themselves actual and their actuality is not derivative upon that of the whole. Once one grants that a whole is nothing other than its parts taken collectively, it is natural to wonder how the properties of the whole are related to the properties of the parts. It seems clear that wholes do have properties had by none of their parts, but, given the two theses, it also seems very plausible to suppose that the properties of a whole are derivative upon the properties of its parts—that the apostles are twelve is accounted for by each apostle being one and there being twelve apostles. As Cross has stressed, Ockham and many other medieval thinkers endorse the principle that "the immediate subject of any accident is exactly as simple as the accident "[29] If one supposes, with Ockham and Buridan, that every substantial form in nature (other than the human intellectual soul) is extended and composed of parts, it follows that the properties of which the whole substantial form is the subject are going to be derivative upon the properties of its parts, and that the properties of the composite as a whole will be derivative upon the properties of the parts of the form and the parts of the matter Since the integral parts of the form parallel exactly the integral parts of the matter it informs, and since the matter is itself something existing in its own right, it is a very short step to the abolition of the traditional distinction between form and matter and the supposition that the properties of the parts of the composite are all properties which have the actual material parts of the composite as their subjects And this is precisely what we find in the "modern" philosophers of the seventeenth century Medieval mereology has provided a metaphysical foundation for early modern Physics!

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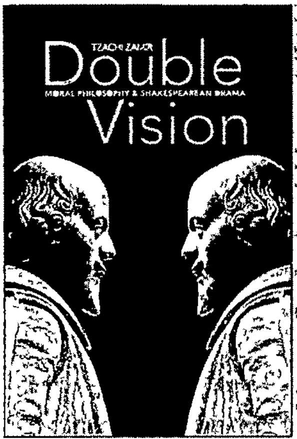
[29] Ockham IV Sent q 9 *OT* VII, 163 ll 10–11, cited in Cross, "Ockham on Part and Whole," p 164

Elegant



Double Vision

Moral Philosophy and
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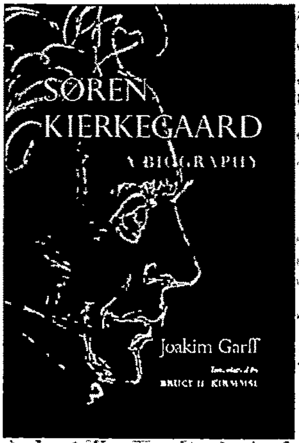

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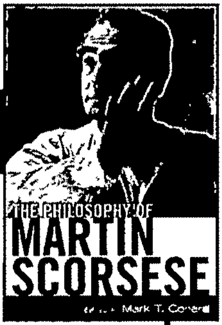

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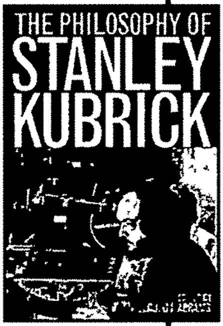

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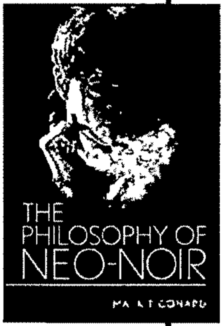

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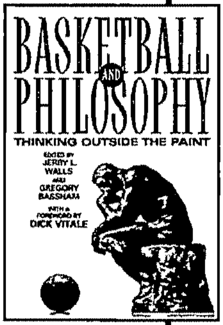
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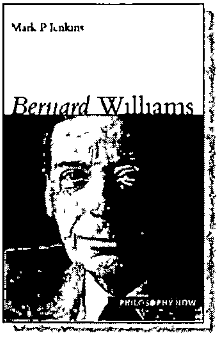

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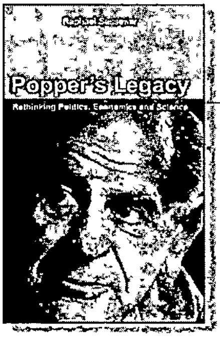

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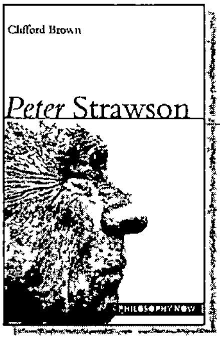

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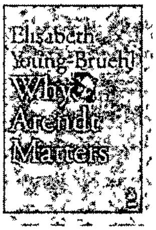

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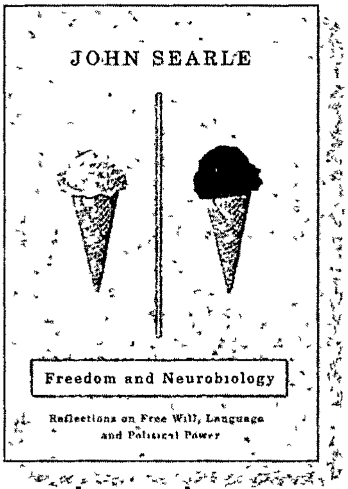

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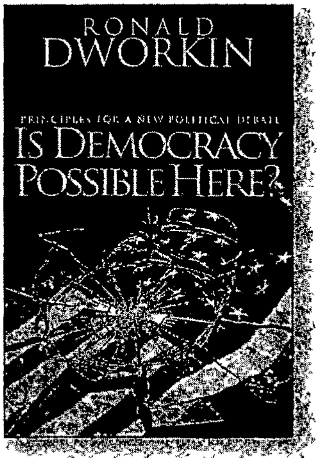

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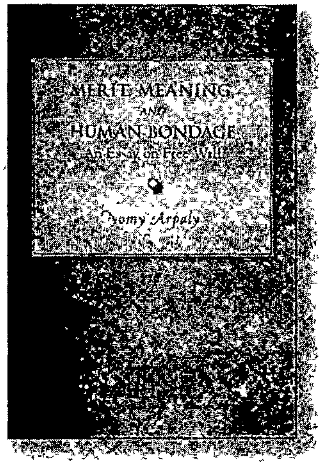

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